ELECTRONICS & TECHNOLOGY TODAY!

CANADA'S MAGAZINE FOR HIGH-TECH DISCOVERY

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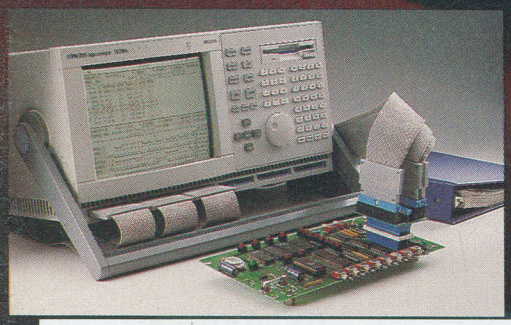
Warm up to rich, mellow

TUBE SOUND

Basic Electricity #8

C Language Programming

Wireless Controller



New Philips Logic Analyzer from Fluke

513735*JAN 92* ET27* *
KEVIN JOURNEAUX
68 EASTON AVE
MONTREAL WESTPQ H4X 1K8

ronic Supply Catalogue

WORKING LATE

''Well, that's done. Feel like stopping off for a drink when we leave?''

''Thanks, but I'll save it for home. I'm driving tonight.''

Seagram

P.O. Box 847, Station H, Montreal, Quebec, H3G 2M8

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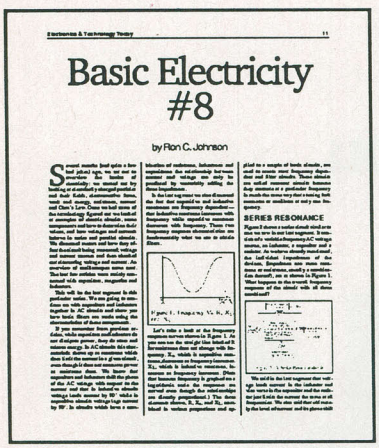

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by Ron C. Johnson

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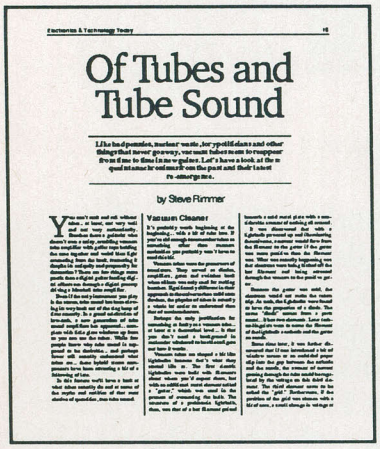

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by Steve Rimmer

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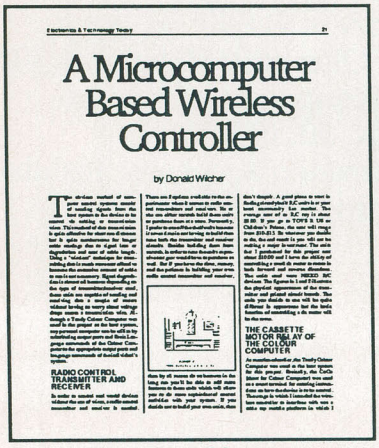

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by Donald Wilcher

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ELECTRONICS & TECHNOLOGY TODAY!

CANADA'S MAGAZINE FOR HIGH-TECH DISCOVERY

Volume 15, Number 9 November/December, 1990

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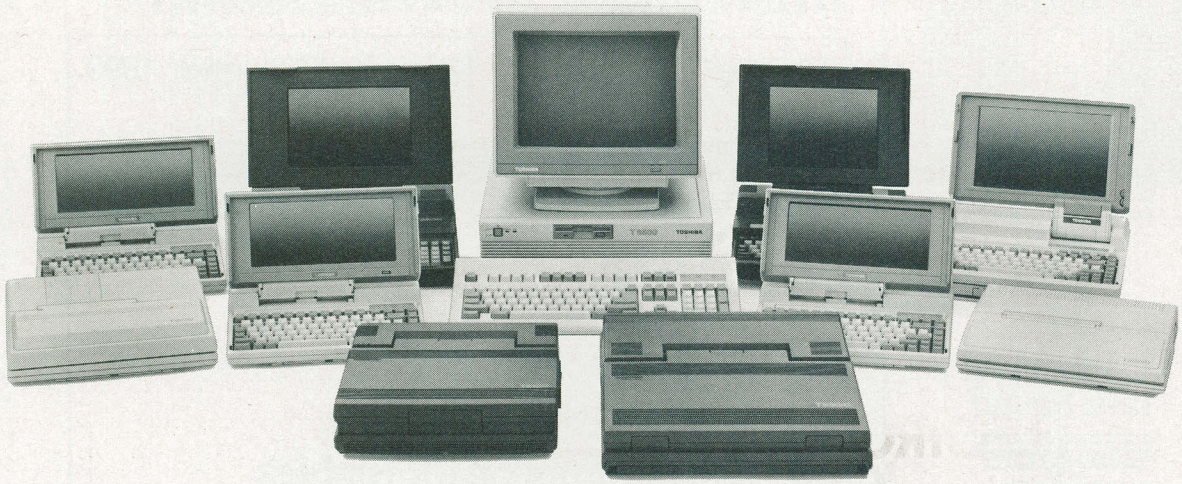
Toshiba takes nature's concept: Small yet extraordinarily powerful.

And makes it work for you.



Without question, Toshiba's "First Family" of portable computers demonstrate the perfect combination of power, performance, quality and portability. That's why the vast majority of all portable PC's sold in Canada, proudly carry the Toshiba name.

SAVE UP TO $1,479 on Toshiba Memory, Microsoft Windows 3.0® and a Microsoft® mouse.

Right now, when you purchase any Toshiba 80386 or 80386SX® portable computer*, you'll receive a valuable coupon. Mail it to Toshiba, with your proof of purchase and we'll send you the revolutionary Microsoft "Windows" 3.0® with a Microsoft mouse (list price $279)–FREE. Plus, if you wish, you can also purchase the genuine Toshiba optional 2MB Memory Board for these powerhouses for just $699 (plus provincial sales tax where applicable). Normally the Canadian list price for 2MB of genuine Toshiba memory is $1,899! So, don't delay. Offer ends November 30, 1990 (coupon must be post-dated prior to Nov. 30, 1990).

3.0

(Microsoft® Windows™* version 3.0)*

For more information about any Toshiba microcomputer products, call: 1-800-387-5645.

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INFORMATION SYSTEMS GROUP

*Offer available on Toshiba T3100SX, T3200SX, T5100 and T5200 portable computers purchased between September 1, 1990 and November 30, 1990 or while supplies last. Allow 4 to 6 weeks for delivery. 386SX is a registered trademark of Intel Corporation. Microsoft Windows 3.0 is a registered trademark of Microsoft Corporation. OFFER ONLY VALID IN CANADA THROUGH AUTHORIZED TOSHIBA RE-SELLERS.

Circle Reader Service Card No.1

Editorial

Hi again, everyone. Before I say anything else, I'd like to wish all our readers a very happy holiday season and a great New Year! From everyone at Moorshead Publications, we hope that you and your family have good health and much happiness in 1991.

We have lots of great plans and ideas for *Electronics & Technology Today* in the new year. Some of the subjects we plan to feature include: The History of Electricity and Electronics, Electronics Software, Electronics and Music, Electronic Servicing, Ham Radio, Circuit Design, and Aviation Electronics.

As always, we welcome your input. If you have any suggestions or comments, please let me know. Also, if you would like to submit an article or project, I would really like to see it.

My goal for *Electronics & Technology Today* remains unchanged. I want it to be the best and highest quality publication of its kind. Your participation will greatly assist in this endeavour.

Chuck Ander
Editor

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CANADA'S MAGAZINE FOR HIGH-TECH DISCOVERY

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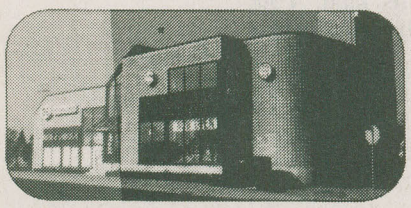
New Products

Over 20 Years in the Science Business in Canada

Where do you go if you want to purchase a Whimhurst Static Electric Machine, a working laser, a whitenoise generator, a boomerang, a home weather station or a model nuclear power plant based on Three Mile Island? Where do you go...Efstonscience.

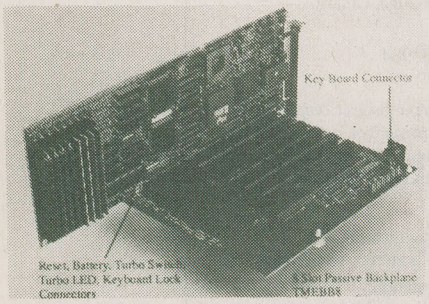


Efstonscience is a two-storey science emporium containing everything you could want in the scientific field. For more information, contact: Efstonscience Inc., 3350 Dufferin St., Toronto, Ontario M6A 3A4 Tel: (416) 787-4581-5 Fax: (416) 787-5140.

Circle Reader Service Card No.2

New Concept in Computer Boards

Toronto MicroElectronics Inc. of Mississauga is selling a new, vertically mounted 386 computer mother board. The TME 386DX-25/33 Passive Backplane CPU Board is designed to give



the system integrator maximum flexibility for system configuration. Each model is a single-card processor platform, providing the advantages of full AT compatibility to a wide variety of applications.

A high degree of reliability is achieved using sate-of-the-art Application Specific Integrated Circuits (ASIC) and Surface Mount Technology (SMT). With these design techniques, these 386DX-25/33 CPU boards are built to the same dimensions as the PC/AT peripheral cards and offer high performance in a convenient form factor.

A Six-layer, high quality, Canadian-made PCB is used to help assure the reliability expected in demanding industrial applications. Every single CPU Card goes through an extensive QA with 48-hour Dynamic Burn-In at 65°C.

For more information, contact: Toronto MicroElectronics Inc., 1848 Bonhill Rd., Suite 1, Mississauga, Ontario L5T 1C4, Tel: (416) 564-4833, Fax: (416) 564-4768.

Circle Reader Service Card No.3

HP Announces Breakthrough in Bright-Yellow LED Technology

Mississauga, Ontario — Hewlett-Packard (Canada) Ltd. today announced the development of what it believes will be the world's brightest light-emitting diode (LED) lamp.

The device has a luminous efficiency of 20 lumens/ampere at 590 nanometres, which is approximately 10 times greater than existing yellow LED technologies, and is as bright as the highest-performance red ALGaAs (aluminum gallium arsenide) LED devices available.

"This is a major technological breakthrough," said Bob Derham, district sales manager, Components Group. "HP's bright-yellow devices will open doors for new opportunities in yellow LED applications, particularly for automotive exterior lighting and outdoor message panels."

The new lamps typically have an on-axis luminous intensity of 5 candela when packaged in a T-1 3/4 lamp package with a half-power viewing angle of 6 degrees and driven at 20 mA.

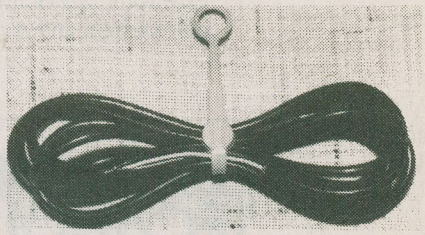
They are fabricated from an AlInGaP (aluminum indium gallium phosphide) hetrostructure, which is grown on a GaAs (gallium arsenide) substrate.

HP also will use its AlInGaP technology to develop green and orange emitters. The high-brightness yellow LEDs are expected to be available in one year.

Circle Reader Service Card No.4

European Pull Tie Now Available in Canada

After having gained wide acceptance in Europe and the United States, a reusable economic, plastic "Pull Tie" is now available in Canada, according to R.G. Klimpel, President of R.K. Klimpel International.



"It tidies up electrical wires and cords," says Klimpel. "It's perfect for the area behind computers, stereos, videos and televisions. It wraps around wires and has a ring on the end for easy pulling and it can be hung from a hook for convenient access."

The Klimpel Klip maintains its form and is ideal for any kind of tying. Use it for plastic bags of ice cubes, frozen foods and other bags which are frequently opened.

The Klimpel Klip is manufactured in West Germany and distributed in Canada by R.K. Klimpel International. For more information, contact: R.K. Klimpel International, 40 Lyncroft Dr., West Hill, Ontario M1E 1X7, Tel: (416) 282-6380.

Circle Reader Service Card No.5

Digital Recorder for 911 Calls

London, Ontario — Lanier Canada, Inc. today introduced the Digital Dispatch Recorder (DDR) 2000, the first digital network architecture approach

to digital recording for emergency/911 communications centres.

This network approach, the only one of its kind on the market, allows supervisors to monitor each position from their own console. The supervisory console is connected to a central processing unit that is networked to the dispatch centre consoles. This allows supervisors to review calls without disturbing the operator who may be handling a new incoming call.

Another advantage of the DDR 2000 is the Automatic Number Identification system that automatically displays the phone number of the incoming party in E911 applications. This saves dispatchers time in searching for previous calls.

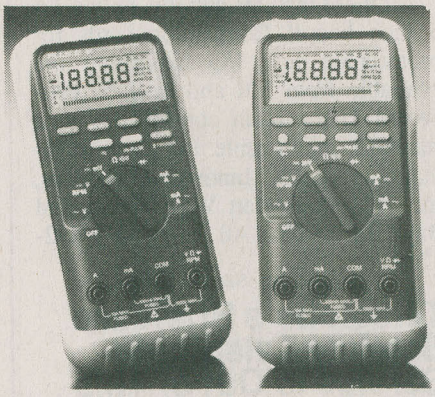
The DDR 2000 also offers a non-distorted speed control for slowing down incoming audio without distortion. "This is very important in dispatch situations when incoming callers are often taking very quickly and may be hysterical," said Blair Melton, National Product Marketing Manager, Lanier Canada. For more information, contact: Maureen Murphy, Marketing Coordinator, Lanier Canada, P.O. Box 3143, London, Ontario N6A 4J4, Tel: (519) 668-2230 Fax: (519) 668-2338.

Circle Reader Service Card No.6

New Automotive Meters Address Growing Sophistication of Automotive Electronics Systems

Two new handheld automotive meters introduced by Fluke Electronics Canada Inc. help automotive service technicians to more quickly and accurately troubleshoot sophisticated automotive electronics systems and components. The new Fluke 86 and Fluke 88 Automotive Meters offer a new specified set of features most needed by automotive technicians.

Both the Fluke 86 and Fluke 88 provide exceptional automotive meter capabilities. They contain all the basic meter functions including volts DC and AC, amps DC and AC and resistance, plus a full set of automotive features,



including RPM, Change Alert™, frequency, duty cycle, and pulse width. Also included is an Inductive RPM pickup for measuring RPM for 4-cycle, 2-cycle and DIS waste spark engines, and milliseconds pulse width to test on-time of fuel injectors, idle air control motors and electronic transmission controls.

In addition, the new meters offer Min Max™ recording which records the minimum and maximum readings, and averages the readings taken over a period of time. This allows the units to check current draw and voltage drops in starting and charging circuits, as well as monitoring oxygen and other sensor voltages. The Touch-Hold® function beeps when the meter senses a stable reading and locks it on the display for convenient viewing after the test leads have been removed.

A precision analog display is standard, useful for observing oxygen sensor voltage, sweeping throttle position sensors and taking other variable readings. A 10-megohm impedance protects sensitive automotive computers.

Both the Fluke 86 and 88 are built of rugged construction to military standards. Included with each unit is a 9V battery (installed), carrying case, protective holster with Flex Stand™, and inductive pickup. A water and grease-resistant user's manual and a quick reference guide are also included. A deluxe test lead set including TL24 heat resistant test leads, TP20 needle point probes and AC85 alligator clips are available on the Fluke 88. The Fluke 86 comes with TL70 probes and AC70 alligator clips. For more information, contact: Fluke Electronics Canada Inc., 400 Britannia Rd. E., Unit #1, Mississauga, Ontario L4Z 1X9 Tel: (416) 890-7600, Fax: (416) 890-6866 or Tracy Fath, Inquiry Management Systems, 3289 Lenworth Drive, Mississauga, Ontario, L4X 2H1, Tel: (416) 629-1379.

Circle Reader Service Card No.7

PC Thermal Alarm Warns Users When It's Time to Shut Down

CARP, ONTARIO, Sept. 10, 1990 — A new computer alarm system is providing PC users with inexpensive insurance against lost data and annoying downtime.

Called the *PC Thermal Alarm*, this compact device monitors the interior temperature of the computer and signals the user when the maximum safe operating temperature has been reached.

"Until now, PC owners had no way of knowing what was happening inside their computer," explains Comprotec's senior partner Bruce Taber. "They could only assume that everything was operating within the recommended temperature range. The PC Thermal Alarm takes the worry out of the unknown."

Excessive heat within the chassis of a personal computer has been a problem since PCs were first developed. Despite cooling fans, and carefully planed ventilation and air flow characteristics, less-than-perfect aftermarket conditions can result in overheating and ultimately computer failure.

"According to computer manufacturers, the maximum safe operating temperature within a PC should not exceed 45°C," says Taber. "However, blocked vents, add-ons, fan failure, or even placement near a window or a hot air register, can result in overheating causing thermal wipeout or component failure."

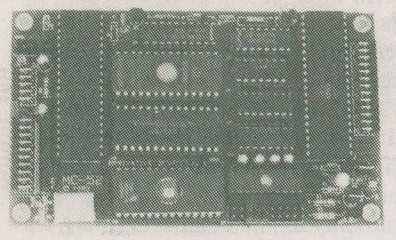
The PC Thermal Alarm is powered by one of the spare disk drive power cables and its efficient micro-power design will not contribute to potential overheating problems. When the alarm sounds, users simply save their work and shut down the system long before serious problems can begin. Rectifying the problem may be as simple as

moving the PC to a cooler location. For more information, contact: Bruce Taber, Senior Partner, Comprotec Canada, R.R. #2, Carp, Ontario, K0A 1L0, Tel: (613) 256-5437.

Circle Reader Service Card No.8

MC — 52C, The Little Controller Who Could

Innovative Devices, Inc. (IDI) has designed the MC — 52C Microcontroller specifically to develop prototypes and implement limited scale production in as short a time as possible. For many projects, its flexible architecture will eliminate the design and construction of specific prototypes, and the expansion capability allows it to fill a role as a production module as well. This powerful tool supports personal computers as a platform for program development for the stand alone controller or as a host for its use as a slave processor.



Any programs written with industry standard '51 series microcontroller assemblers and "C" compilers will run in the MC -- 52C (the MC — 52B, a version with built-in floating point BASIC is also available).

All the on-chip resources (I/O ports, 3 counter-timers, UART, interrupts and programmable counter array) are wired to headers on the board edge. In addition, the MC — 52C had 24 digital I/O lines brought out to a 26 pin header.

Up to 96 Kbytes of memory can be installed on the MC — 52C in a mixture of RAM and EPROM, in any mixture of 8 Kbyte and 32 Kbyte memory parts. IDI thought it would be nice if a first-time user could get the board running without a lot of aggravation and anxiety. To this end, the board comes with an 8K by 8 ram chip and is ready to run without any further work. A single 5 volt supply is required for the controller and the RS-232 level shifter/power supply. The Real Time Clock my be used as a periodic interrupt source, and the system may be put into low power "sleep" mode, and then awakened with the RTC or another external interrupt.

The system is expandable, and the multiplexed address and data bus is brought out to an expansion connector along with read/write signals and a decoded line for a block of memory mapped expansion I/O.

All these features and it is only a 3 x 5 inch board! Companion cards for prototyping and I/O expansion are available from IDI and may be connected to the main controller with a standard ribbon cable. For more information, contact: Innovative Devices, Inc., 1119 Damelart Way, Brentwood Bay, B.C. V0S 1A0 Tel: (604) 652-5240.

Circle Reader Service Card No.9

Teleglobe's Briefcase Satellite Telephone Service is Out of This World!

You're in the Amazon setting up a branch plant. How are you going to keep in touch with the Head Office? Teleglobe's developmental briefcase service, allows you to touch base in Canada using Inmarsat's mobile satellite network.

Teleglobe, along with Inmarsat, is currently testing the world's first global International Mobile Earth Terminal (IMET) service using the Inmarsat satellite network. The experimental service will provide voice and data transmissions between a test group of 18 lightweight, self-contained "briefcase" terminals and the international public telephone network. Subscribers will be able to use the service in North and South America, Western Europe and Africa.

This is the world's most portable and easy-to-use satellite terminal. It takes less than a minute to set up and weighs only 32 lbs, including antenna, battery and carrying case. By simply attaching the antenna to the back of the aluminum briefcase and pointing toward the nearest Inmarsat satellite, the user is ready to place or receive calls to any country in the world where the service is licensed.

"The briefcase terminal represents the next generation of cellular telephones," says Mark Harris, Director of Transmission Engineering at CBS television in the US, one of the active supporters of the service and a test group participant. "It will be a vital communications link between our CBS News headquarters and CBS personnel in the field. We'll get on-the-scene coverage as well as still photos from difficult-to-access locations." Teleglobe envisions that the service will also prove useful to the news media, diplomatic corps, disaster relief teams, remote construction projects and others requiring communications from locations where public services are not available or have been interrupted.

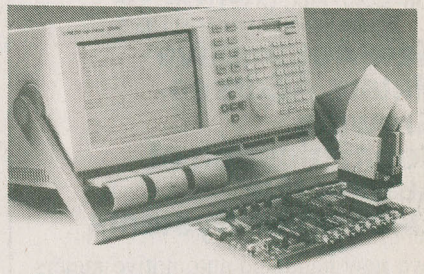
According to Joel Duchoeny, Product Manager at Teleglobe: "In a world that is constantly moving toward more versatile communications, we believe that the new service will open up a whole new dimension in mobile communications with a broad range of possibilities." Plans are under way to introduce a global service to the public by 1991-1992. "Teleglobe's service is two to three years ahead of everything else," says Joel Duchoeny. "It's part of our commitment to push mobile communications forward." The terminals are being produced by Sky Wave Electronics Ltd., of Ottawa, based on technology developed by the Canadian Department of Communications. For more information, contact: Teleglobe Canada Inc., 680 Sherbrooke St. W., Montreal, Quebec,

H3A 2S4, Tel: (514) 289-7118.

Circle Reader Service Card No.10

Fluke Introduces New Philips Logic Analyzers

Fluke Electronics Canada has introduced a new Philips PM 3580 family of easy-to-use logic analyzers (see front cover) that users can have up and running in less than 30 minutes. Ordinary logic analyzers can take up to eight hours to set up and learn.



The new Philips PM 3580 family of logic analyzers offers faster analysis by reducing state and timing measurements to one probe connection, one set up to learn, and fully-integrated state and timing triggering for a common human interface. All measurements are

time tagged with up to five nanoseconds resolution.

The new PM 3580 family of logic analyzers features a unique dual-analyzer-per-pin architecture. This allows both state data (relating to software functioning) and timing data (relating to hardware performance) to be acquired simultaneously from the system on up to 96 channels, using just a single set of probes. Performance specifications are 50 MHz state, up to 200 MHz timing and 2k memory per channel.

Traditional logic analyzers, with strictly separate state and timing analysis sections, require dual-probing or time-consuming successive acquisitions to obtain both these types of data from a set of signals. The difficulty of securely attaching multiple probes makes dual probing potentially unreliable while, at the same time, bringing with it the risk of excessively loading the target system.

Compared to traditional instrument designs, fewer channels are needed for digital debug. For example, a user working on an 80286 microprocessor-based system who wants to look at state information and bus timing, would need 48 channels for state recording and, perhaps, 32 channels for timing analysis, or a total of 80 channels. With the new PM 3580 architecture, only 48 channels are required.

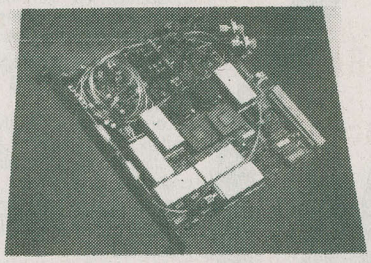
Integrated triggering and complete time tagging are also unique to PM 3580 family architecture. On each of the eight trigger levels, the user can select from three timing words, plus "Edge," "Glitch," and "Time out," or up to eight state words. On each level, selective storage for the state record can be set (range, state word, or a combination of state conditions).

The new PM 3580 family of instrument range in price from a low of Cdn. $5,960 excl. taxes for the PM 3580/30, with 32 channels of 50 MHz state recording and 32 channels of 100 MHz timing. and 1k deep memory; to Cdn. $16,183 excl. taxes for the PM 3585/90 model offering 96 channels of 50 MHz state and 96 channels of 200 MHz timing recording with 2k memory. For more information, contact: Tracy Fath, Inquiry Management Systems, 3289 Lenworth Drive, Mississauga, Ontario L4X 2H1 or David Churchill, Fluke Electronics Canada Inc., Tel: (416) 890-7600.

Circle Reader Service Card No.11

Technology Breakthrough in Fiber Optics Consortel Network...One Fiber Does it All

The forward thinking of Government officials, an innovative phone company (Quebec Telephone) and an open-minded cable operator (Cogeco), has created a major new network capability using fiber optics and advanced technology. The network will make it possible for users to benefit from new services, such as remote eduction, live cultural programs, advanced security and improved energy management.



Consortel, the research and development partnership formed to bring fiber to the home, has successfully installed a network capable of providing video, voice and data on one fiber. The trial has been taking place in Rimouski (Quebec). Robert Duchesne, Vice-President of Marketing, Quebec Telephone said, "The announcement today of the third phase of the trial is extremely promising. Quebec Telephone sees the possibility of providing new services to our customers using this advanced network capability and is excited at the new choices that can be offered."

Management of Consortel is now actively seeking investors to take the advanced network to market. Richard Arsenault, Director of Consortel, said, "Our research teams have succeeded in major technology breakthroughs using fiber optics. Consortel now needs to take this product from a very successful trial to a fully tested market-ready network.

We are confident in our ability to make Consortel a world leader for Canada in fiber network technology. We are also pleased to be able to bring the potential of export dollars and jobs to Quebec." For more information, contact: Jean-Pierre Poirier, Consortel, 1120 St Regis Blvd., Dorval, Quebec H9P 2T5, Tel: (514) 421-5344.

Circle Reader Service Card No.12

Announcing Maple™ V for Sun Workstations

Waterloo Maple Software is now shipping Maple V for SPARC™-based and Sun™-3 families of workstations. Maple V is a completely new version of the powerful, interactive computer algebra system used for both symbolic and numerical computations.

This release features a completely new graphical user interface and 3D graphics. Maple V is built upon industry standards such as UNIX, the X Window System, TCP/IP and PostScript. With its comprehensive library containing over 2,000 functions for all areas of mathematics, Maple is used wherever accurate computation is needed.

"Maple is already the acknowledged leader in computational power, speed and accuracy. With its new features, Maple V is the clear choice for solving the problems of today's engineers. Our release for the Sun is a strategic move because it addresses one of Maple's largest customer bases," states Ron Neumann, Chief Executive Officer.

"We are seeing increasing interest for Maple from our customer base," said Van Jepson, director of worldwide education and research marketing at Sun Microsystems. "The combination of SPARC and Maple provides a powerful solution to our instruction and research communities."

Maple users at over 1,000 sites worldwide rely on the system for a variety of applications in science and engineering. Maple can be a powerful aid for developing sophisticated analytical models to deal with difficult problems. Its superior algebraic engine and 3-D graphing capabilities allow users to manage and visualize complex scientific and engineering information in new and exciting ways.

The introductory price for Maple V for Sun is $2,495 (U.S.) Discount pricing for academic institutions and site licenses are available. The previous version of the software is currently running on 1500 licensed Sun workstations across North America and Europe. For more information, contact: Waterloo Maple Software, 160 Columbia St., W., Waterloo, Ontario N2L 3L3, Tel: (519) 747-2373 Fax: (519) 747-5284. ❐

Circle Reader Service Card No.13

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FEATURE

Basic Electricity #8

by Ron C. Johnson

Several months (and quite a few bad jokes) ago, we set out to overview the basics of electricity: we started out by looking at electrically charged particles and their fields, electromotive force, work and energy, resistance, current and Ohm's Law. Once we had some of the terminology figured out we looked at examples of electric circuits, some components and how to determine their values, and how voltages and currents behave in series and parallel circuits. We discussed meters and how they affect the circuit being measured; voltage and current sources and then checked out alternating voltage and current. An overview of oscilloscopes came next. The last few articles were mainly concerned with capacitors, magnetics and inductors.

This will be the last segment in this particular series. We are going to continue on with capacitors and inductors together in AC circuits and show you how basic filters are made using the characteristics of these components.

If you remember from previous articles, while capacitors and inductors do not dissipate power, they do store and release energy. In AC circuits this characteristic shows up as reactance which does limit the current in a given circuit, even though it does not consume power as resistance does. We know that capacitors and inductors shift the phase of the AC voltage with respect to the current and that in inductive circuits voltage leads current by 90° while in capacitive circuits voltage lags current by 90°. In circuits which have a combination of resistance, inductance and capacitance the relationship between current and voltage can only be predicted by vectorially adding the three impedances.

In the last segment we also discussed the fact that capacitive and inductive reactances are frequency dependant—that inductive reactance increases with frequency while capacitive reactance decreases with frequency. These two frequency response characteristics are fundamentally what we use to obtain filters.

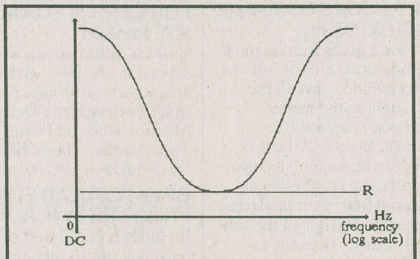


Figure 1. Frequency Vs R, X_L, and X_C

Let's take a look at the frequency response curves shown in Figure 1. As you can see the straight line labelled R for resistance does not change with frequency. X_C, which is capacitive reactance, decreases as frequency increases. X_L, which is inductive reactance, increases as frequency increases. (Note that because frequency is graphed on a logarithmic scale the responses are curved even though the relationships are directly proportional.) The three elements shown, R, X_C, and X_L, combined in various proportions and applied to a couple of basic circuits, are used to create most frequency dependant and filter circuits. These circuits are called resonant circuits because they resonate at a particular frequency in much the same way that a tuning fork resonates or oscillates at only one frequency.

SERIES RESONANCE

Figure 2 shows a series circuit similar to one we saw in our last segment. It consists of a variable frequency AC voltage source, an inductor, a capacitor and a resistor. As we have already mentioned, the individual impedances of the devices, (impedance can mean reactance or resistance, usually a combination thereof), are as shown in Figure 1. What happens to the overall frequency response of the circuit with all three combined?

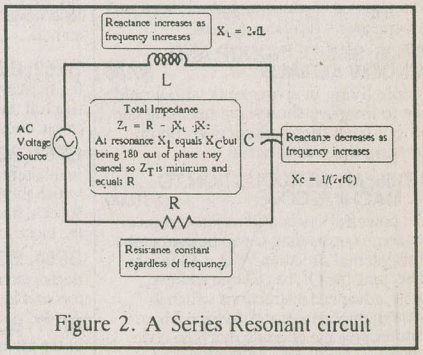


Figure 2. A Series Resonant circuit

We said in the last segment that voltage leads current in the inductor and vice versa in the capacitor and the resistor just limits the current the same at all frequencies. We also said that ultimately the level of current and its phase shift

with respect to the input voltage was determined by a combination of all the components and could only really be determined using vector algebra.

So the frequency response is really a graphical representation of that current with respect to frequency. If we calculated the current flowing in the circuit for each value of the source frequency we would have the overall frequency response curve. Another way of looking at it would be to take the resistance, capacitive reactance and inductive reactance, (in other words, the total impedance) of the circuit at each frequency, and use it to find the total current, and then graph the frequency response.

So what is it in the case of a series circuit like in Figure 2?

At low frequencies capacitive reactance is very high, while inductive reactance is low and resistance is a constant value. Because X_c is high very little current flows. As the frequency of the source is increased capacitive reactance decreases, as can be seen from Figure 1, and while inductive reactance increases, it is still at a fairly low value a the middle of the graph. At high frequencies X_c is very low but at that point X_L is high so the total impedance is again very high and current flow is minimal. At about the middle the graph X_c and X_L are equal, but keep in mind that we have said that inductive and capacitive reactances have a phase shift attached to them: capacitive reactance is -90° while inductive reactance is +90° which makes them 180° out of phase. Because they must be added vectorially, they cancel each other out, and at that point, which is called resonance, the reactive component is zero, leaving only the resistance to limit the current in

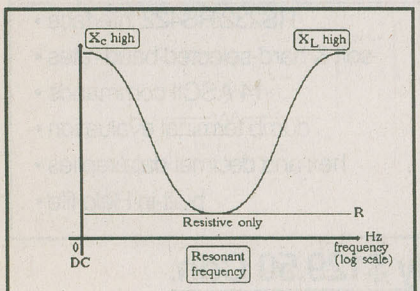


Figure 3. Series Resonant response

the circuit. See Figure 3. Naturally the opposition to current flow at this point is at a minimum and so current is maximum at resonance. In addition, there is no phase shift between the voltage source and the circuit current because the reactive components have cancelled each other out.

PARALLEL RESONANCE

A series circuit is only one basic configuration in which you will see resonant circuits. The other main circuit, as we have seen in past segments,

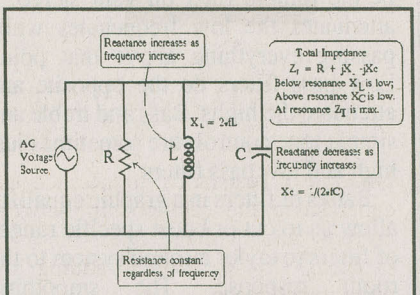


Figure 4. A Parallel Resonant circuit

is the parallel circuit. Figure 4 shows a parallel resonant circuit in which the resistance, inductance and capacitance are connected in parallel with, in this case, a variable frequency current source. In this circuit the individual components behave in exactly the same way as before, but because they are in parallel we obtain a different result.

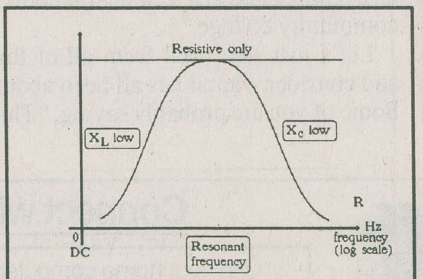


Figure 5. Parallel Resonant response

As is shown in Figure 5, at low frequencies X_L is low and X_c is high. If we measure the voltage across the parallel circuit, because X_L is low, the overall impedance of the three components in parallel is low and the voltage will be low. At high frequencies the opposite is true: X_L is high but X_c is low so, again the parallel impedance is low and the voltage across the circuit is low. At some point in the middle, however, where X_c equals X_L (and they are 180° out of phase) the reactive components again cancel each other out leaving only the resistive component. At this point the overall impedance of the circuit (which is R only) will be at its maximum and therefore the voltage across it will be maximum.

So for a series resonant circuit, at the resonant frequency, the circuit impedance is low and current flow is maximum. For a parallel resonant circuit, at the resonant frequency, the circuit impedance is maximum and the voltage output is maximum. For both types of circuit, at resonance the capacitive and inductive reactive components are equal and 180° out of phase and therefore cancel each other out making the circuit purely resistive and the phase shift in the circuit is zero. The actual frequency of resonance is determined by the values of the capacitive and inductive components.

QUALITY FACTOR

We said that the resonant frequency was a function of what inductive and capacitive component values were chosen. What about the resistor shown in the resonant circuits? What effect does it have on the frequency response curve?

While the resistance does not affect the centre frequency of the resonant response it does have an effect on what is called "quality factor." Quality factor is a number which indicates how selec-

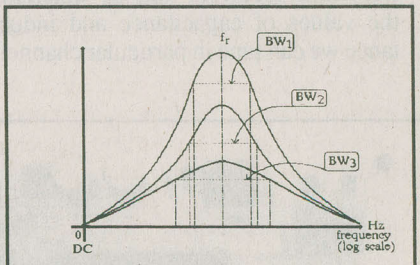


Figure 6. Three different quality factors

tive the circuit is. Figure 6 shows three different resonant responses superimposed on each other, all centred on the same frequency but with different quality factors. In order to determine the bandwidth (range of frequencies passed) of the circuit we use what are called the half-power points on the response curve. Half-power points are the point on the curve where the amplitude of the frequency at that point

would deliver half as much power to a load as the centre frequency would. If you work it out mathematically you would find that half-power corresponds to .707 times the peak voltage or current. These points are shown on the graph for each response curve. You can see that as the quality factor increases (highest response) the half-power points become closer together. This causes the bandwidth of the frequencies passed by the circuit to become smaller or more selective. Generally we consider more selective filter circuits to be more desirable because we have better control over a small band of frequencies. Quality factor applies to both series and parallel resonant circuits.

The question now becomes: how does all of this apply to circuits we may work with as hobbyists or beginners in electronics? The important thing here is to understand in a qualitative way why capacitors, resistors and inductors are put together in certain combinations to create circuits which are frequency dependant. At various times in this magazine and other sources you will see filter circuits which are used for various purposes.

Bandpass filters are one kind of frequencies dependant circuit that we have already looked at. They pass a certain range of frequencies while blocking out all others. Bandpass filters are the main type of filter used in radio and television receivers and by changing the values of capacitance and inductance we can tune in particular channels or stations which broadcast at a known frequency while rejecting all the others. While the circuits employed to maximise the quality factor and other filter requirements can become complex, the basic circuit concepts are the same as we have discussed.

We can also build high pass or low pass filters by leaving out either the capacitor or inductor and increasing the gain of the circuit using amplification. An example of a high pass filter would be the rumble filter on your stereo. It attenuates the low frequencies while passing everything above that point. Low pass filters do the opposite and attenuate the highs. Bass and treble and simple tone controls are sometimes just high and low pass filters.

Banks of filters in a graphic equalizer allow us to cut or boost specific ranges of filters to taylor a sound system to the room response. The smoothing capacitors in DC power supplies are really just low pass filters, designed to attenuate all frequencies above DC.

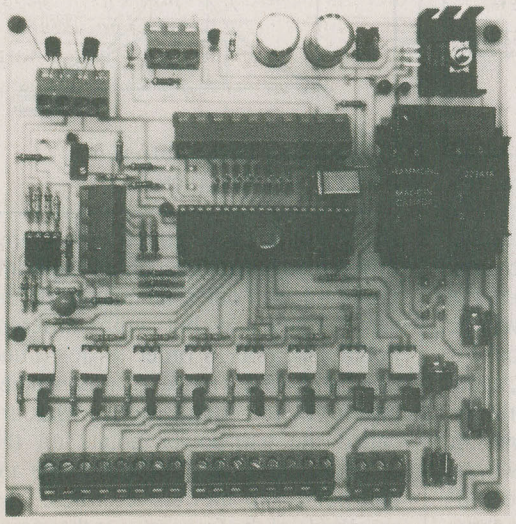
Well, that about wraps it up for this area of basic electricity. That is not to say that we have covered everything to the depth that we could have but, as we set out to do, we have overviewed the subject in a qualitative way. If you want to dig deeper into the mathematics behind this stuff you would do well to take an evening class at a technical school or community college.

Let's just step back from all of this and consider what it has all been about. Some of you are probably saying, "This has been an eight part series and we still haven't talked about semiconductors, integrated circuits or any of that good stuff." That is true but having familiarized yourself with the basics, you will find that this stuff will support the more advanced information and you will understand it better.

For instance: Knowing the difference between a voltage source and a current source, what their individual characteristics are, the practical considerations of internal resistance and maximum power transfer helps you to understand why DC power supplies are designed the way they are, input and output impedance in audio amplifiers, speaker loading, how batteries work and why they behave the way they do when they are partially discharged. Series and parallel networks are used continuously in transistor circuits, speaker combinations, digital circuits and lots of other areas. Capacitance and inductance is used, again, in power supplies, timing circuits and filters. Magnetism is used in tape recorders, relays, televisions and industrial electronics.

So where do we go from here?

In subsequent issues I'll be starting a series on semiconductors, considering the theory, some practical applications, and the minimum amount of math required to enable you to design your own basic circuits. To make things a little more interesting I'll give you some simple circuits to set up on a breadboard so you can see for yourself how they work. ❐



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C Language Programming for Techies

Vectors are one of the more mysterious elements of PC architecture, and one that most programmers happily leave alone. There are, however, a number of fairly risk-free applications of vectors and the mutation thereof under C.

by Steve Rimmer

Down at the very bottom of memory in the dungeon of every PC there lives the vector table. It's a typical dungeon dweller, dark and brooking, full of menace... unfathomable. If you venture down to low memory without all the right spells it will probably bring the whole castle down on top of you.

The low memory vector table of a PC is a list of addresses of important basic functions in your computer. This includes things like the BIOS code that decodes your keyboard, the DOS INT 21H handler that handles files and memory allocation, hardware serial port handlers and the code that tells you there has just been a memory parity error and all your work for the past six hours has been lost.

The mechanism of the interrupt vector table is intimately tied up with that of the 8086 series processors that drive PCs. When the processor executes an INT instruction, what it actually does is to make a sort of indirect far call to where the appropriate entry in the interrupt vector table points.

As a far call requires two words to address it... four bytes... the processor would find the entry for INT 21H by multiplying 33... that's 21H in decimal... by four and leaping to the address pointed to by the two words at 0000:0084H.

All of this seems very low level, and probably should not concern programs written in higher level languages such as C. However, being able to successfully meddle with interrupt vectors can be exceedingly useful. You can get around many of the nastier omissions and holes in the architecture of your system, as well as tapping a few hitherto untapped resources.

No tricks, exercise or unpleasant machine language are required.

Crashing Out

If you hold down the control key and hit the break key while a program is running, the BIOS of your computer will print "^C" on your screen and issue an INT 23H instruction. The vector for this interrupt normally points back into DOS, which will terminate the program in question and return you to the command line.

There are all sorts of instances in which you may not wish to have this facility available to the users of your programs. For one thing, it's not all that professional to have your programs crash back to DOS just because someone hits the wrong combination of keys. In addition, if your program uses extended or expanded memory, crashing out like this may leave some memory handles dangling and blocks of extra memory unrecoverable until you reboot your machine.

The way to get around this problem is to replace the normal vector for INT 23H with one that points to code that you've written. Turbo C has a dedicated function for this, called *ctrlbrk*.

Here's a typical replacement control break handler.

```
int myBreak(void)
{
  gotoxy(1,1);
  printf("Leave the control
  break key alone");
```

```
  return(1);
}
```

We would replace the default control break handler with this one as follows.

```
int myBreak();
ctrlbrk(myBreak);
```

There are a number of fiddly details to consider in this process. The first is that the value returned by *myBreak* is important. If it returns zero, your program will do whatever is in your control break handler and then return to DOS. If it returns a non-zero value, your program will resume where it was when the control break key was belted.

Unfortunately, redirecting the control break vector doesn't stop DOS from printing "^C" wherever the cursor happens to be when control break is hit. If you're writing a program with a formatted screen you probably won't want the default system cursor anyway. You can get rid of it with this function.

```
hideCursor()
{
    union REGS r;

  r.x.ax=0x0f00;
  int86(0x10,&r,&r);

  r.x.ax=0x0200;
  r.x.dx=0x1a00;
  int86(0x10,&r,&r);
}
```

This simply sets the cursor onto the line directly below the last line of your screen and keeps it there. If DOS decides to print "^C," it will go undetected. Unfortunately, so will anything else your system decides to print.

In most cases, it's very important that you not alter interrupt vectors and leave them altered when you leave a program. This could result in an interrupt which happens after your program has terminated causing the processor to leap into the middle of a word processing document, for example, and trying to execute the text of your monthly report.

In the case of the control break vector this is not actually a problem... the original vector will be restored for you when your program returns to DOS. We'll look at how to capture and restore other vectors momentarily.

Abort, Retry, Disintegrate

One of the most difficult things to trap for in a complicated program is a user attempting to access a floppy disk which is still in its sleeve five inches immediately to the right of the disk drive it's supposed to be in. The usual result of trying to do this is to have DOS tell you that things are not working out, and ask you if you'd like to abort, retry and so on.

If you select "abort," you'll return to DOS.

If a disk drive runs into trouble accessing a disk, it complains about it by throwing interrupt 24H. This is usually hooked to the code that prints the "abort, retry, ignore" message. However, as with all interrupt vectors, you can redirect it to something which is a bit less catastrophic.

The ideal situation would be to test the drive you wish to access before you go to do so. If it's door is open, you could prompt the user of your program to put a disk in it... rudely, if you're of a mind to.

This process is a bit more involved than the control break handler is because while Turbo C does have the functions to do it, it isn't all that helpful in showing you how to use them.

To begin with, you cannot leave the INT 24H vector dangling when you aren't specifically testing for an open drive... it should always point to the DOS INT 24H handler when you don't have a specific interest in its activities. As such, when you want to test for the status of a drive, you must fetch the old vector and store it somewhere, do what you want to do and then restore the original vector before you move on to better things.

Having saved the old vector, you can point the INT 24H vector to a safe bit of code which need not print anything nasty to the screen.

Here's the code to test a potential disk drive before you go to actually access it. The argument passed to it is the number of the drive you want to test... zero for drive A, one for drive B and so on. What it actually does is to shanghai the INT 24H vector to point to our own handler, which in turn will set the value of *diskErr* accordingly if a disk error transpires.

It will return zero if the drive is accessible.

Having set everything up, the function forces a drive access by attempting to open a file on the test drive. It doesn't actually matter whether the file exists or not.

You will notice that rather exotic looking declaration for *oldHardErr*. This is how you would create a pointer to an interrupt vector. It will turn up again.

```
int diskErr;
char linebuf[81];

testDisk(n)
  int n;
{
  void interrupt
(*oldHarderr)();
  FILE *fp;
  char b[32];

  oldHarderr=getvect(0x24);
  harderr(diskErrorHandler);
  diskErr=0;
  getcwd(linebuf,80);
  sprintf(b,"%c:\\TEMP.DAT",
  n+'A');
  if((fp=fopen(b,"r")) !=
  NULL) fclose(fp);
  setvect(0x24,oldHarderr);
  return(diskErr);
}

#pragma warn -par
int
diskErrorHandler(errval,ax,
bp,si)
  int errval,ax,bp,si;
{
  if(ax>=0) {
  diskErr=1;
  restoreDir(linebuf);
  }
  hardretn(2);
}

restoreDir(s)
  char *s;
{
  strupr(s);
  if(isalpha(s[0]) &&
s[1]==':')
    setdisk(s[0]-'A');
  chdir(s);
}
```

A Bit of Music

The clock tick interrupt, INT 1CH, is among the most useful of PC interrupt vectors for performing sneaky tasks. It's actually run by the PC's hardware. Eighteen times a second it gets called by one of the timer chips. Normally it just points directly to an IRET... a return from interrupt instruction... up in the BIOS, and as such does nothing. However, you can hook it to do all sorts of interesting things.

The most common use of the INT 1CH vector is to drive a screen clock. Resident programs that display the time in the upper right corner of your screen do so by attaching themselves to this vector.

You can make all sorts of independent background processes work in your programs with surprisingly little effort if you know how to manipulate this useful vector. In the following example we'll check out a function which can play random music in the background of any C program, seemingly without any intervention save for setting it loose.

This is not a terribly practical application of the clock tick vector... the music will drive you to madness fairly shortly... but it illustrates the process.

```
void interrupt beNoisy();/*
little music function */

main(argc,argv)
  int argc;
  char *argv[];
{
  void interrupt
  (*oldTimer)();
  int i,r=0;

  /* save the old timer
  interrupt */
  oldTimer=getvect(0x1c);
  /* set the clock tick to play
  tunes */
  setvect(0x1c,beNoisy);

  /*** your program's guts go
  here ***/
  getch(); /* something to
  pause for a while */

  /* undo the clock tick */
  setvect(0x1c,oldTimer);
  /* make sure the sound is
  off */
  nosound();
}

/* this is an interrupt
driven noisemaker. it's
called
 by the hardware about 18
 times a second */
void interrupt beNoisy()
{
  static int scale[7]=
  {220,247,261,294,330,
  349,392};
  static int count,soundon;

  if(soundon && count > 1) {
  count=0;
  nosound();
  soundon=0;
  }
  else if(!soundon && count
  > 2) {
  count=0;
  sound(scale[rand()%7] *
  (rand()%5));
  soundon=1;
  }
  ++count;
}
```

This bit of code illustrates Turbo C's functions for dealing with interrupt vectors it has not specifically planned for. The *getvect* function returns the current interrupt vector and the *setvect* function replaces the current vector with one of your own devising. Because interrupts can happen unexpectedly, make sure you don't go changing their vectors until you're certain your handler is initialized and ready to handle something. As an example of this, if you exchange the order of the *setvect* and *nosound* functions at the end of the *main* function of this little program, the sound will continue to drone on once in a while, as a timer rick interrupt can occur in between the two calls.

The actual handler, *beNoisy*, uses the Turbo C *sound* function to play tunes. It randomly selects note values from the equally tempered C scale at the top of the function. That's the key of C, not the C language in this case.

Because the handler will be called eighteen times a second... it's actually 18.2, but this doesn't matter for our applications... you can count up the number of calls to the handler function to measure time. Thus, if you wanted the note to change one a second, you would increment *count*, in this case, and do something when it reaches eighteen... resetting *count* to zero in the process.

Interruptus

There are numerous other applications for Turbo C's interrupt manipulation functions. In last month's Computing Now, for example, we looked at a way to write an interrupt driven high speed serial port handler using them.

While you should not go meddling with system interrupts without first understanding what they do, the ability to redirect them can give your programs a whole new set of resources. You'll probably want a few good books on system interrupts to fully understand what they're about. ❐

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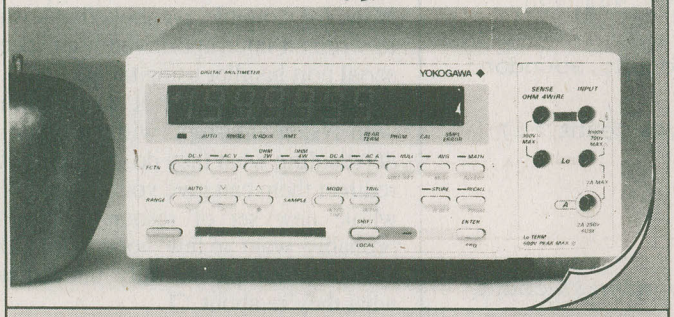

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Of Tubes and Tube Sound

Like bad pennies, nuclear waste, tory politicians and other things that never go away, vacuum tubes seem to reappear from time to time in new guises. Let's have a look at these quaint anachronisms from the past and their latest re-emergence.

by Steve Rimmer

You can't rock and roll without tubes.. at least, not very well and not very authentically. Breathes there a guitarist who doesn't own a noisy, crackling vacuum tube amplifier with gaffer tape holding the case together and weird blue light emanating from the back, treasuring it despite its antiquity and propensity for detonation? There are few things more poetic than a digital guitar feeding digital effects run through a digital preamp driving a Marshall tube amplifier.

Even if the only instrument you play is the stereo, tube sound has been clawing its way back out of the slag heap of time recently. In a grand celebration of low-tech, a new generation of tube sound amplifiers has appeared... complete with little glass windows up from so you can see the tubes. While few people know why tube sound is supposed to be desirable... and perhaps fewer still actually understand what tubes are... these hybrid stereo components have been attracting a bit of a following of late.

In this feature we'll have a look at what tubes actually do and at some of the myths and realities of that most elusive of quantities, true tube sound.

Vacuum Cleaner

It's probably worth beginning at the beginning... with a bit of tube lore. If you're old enough to remember tubes as something other than museum curiosities you probably won't have to read this bit.

Vacuum tubes were the precursors of transistors. They served as diodes, amplifiers, gates and switches back when silicon was only used for making beaches. Significantly different in their approach to the universe than solid state devices, the physics of tubes is actually a whole lot easier to understand than that of semiconductors.

Perhaps the only justification for something as funky as a vacuum tube... at least at a theoretical level... is that you don't need a background in molecular witchcraft to be able to figure out how it works.

Vacuum tubes are shaped a bit like lightbulbs because that's what they started life as. The first electric lightbulbs were built with filaments about where you'd expect them, but with an additional metal element called a "getter," which was used in the process of evacuating the bulb. The structure of a prehistoric lightbulb, then, was that of a hot filament poised beneath a cold metal plate with a considerable amount of nothing all around.

It was discovered that with a lightbulb powered up and illuminating the universe, a current would flow from the filament to the getter if the getter was more positive than the filament was. What was actually happening was that electrons were being kicked off the hot filament and being attracted through the vacuum to the positive getter.

Because the getter was cold, the electrons would not make the return trip. As such, the lightbulbs were found to have the properties of a diode. The name "diode" comes from a parts count... it has two elements. Later techno-linguists were to name the filament of the lightbulb a cathode and the getter an anode.

Some time later, it was further discovered that if one introduced a bit of window screen or an unfolded paper clip into the gap between the cathode and the anode, the amount of current passing through the tube could be regulated by the voltage on this third element. The third element came to be called the "grid." Furthermore, if the position of the grid was chosen with a bit of care, a small change in voltage at

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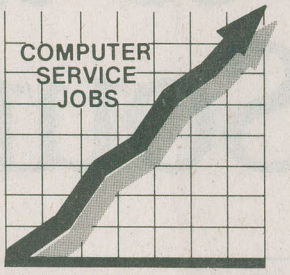

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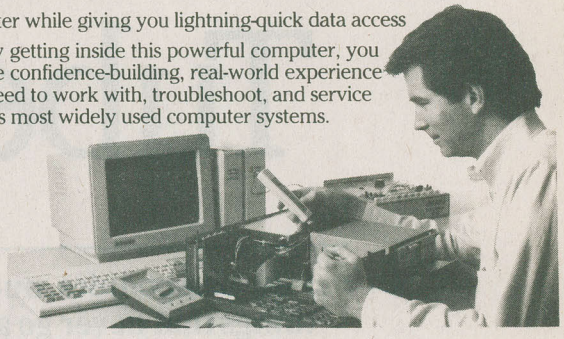

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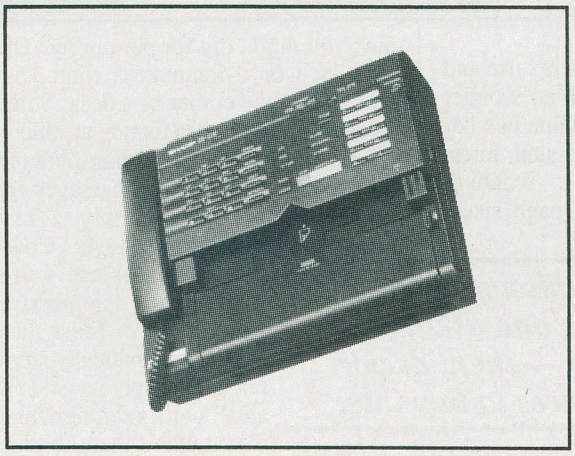
Sharp

If you don't want a lot of bulky Fax features, the Sharp Fax line offers a good sampling of necessary features, with a compact, stylish design.

One of the most attractive features of Sharp's UX-100 is its size: if you don't want, or have, an extra table to hold a heavy Fax machine, this model fits in just about anywhere. Weighing about 17 lb., and taking up the space of a box of chocolates (12.8 in. x 10 in. x 3.9 in. high), the UX-100 can stay within arm's reach, on the corner of your office desk or at home on a kitchen counter.

The UX-100 also has a wide sampling of high-end functions. Its high-speed transmission (a single page can be sent in as little as 15 seconds) means you can cut down on long distance charges. The automatic document feeder accommodates up to 5 pages at a time, freeing you to pursue other work activities, or finish scrambling the eggs on the stove.

The UX-100 also has the intelligence to know the difference between a phone call and a fax transmission and automatically switches over from Fax mode to phone mode as you pick up the receiver. The phone is also independent of the Fax machine; if the UX-100 is down or the power is off, you can still use the phone which features redial, on hook dial and hold.



Finally, the UX-100's resolution and halftone control round out its communications abilities. Resolution can be in Fine or Standard mode, and the unit allows for 16 shades of grey for the transmission of photographs and illustrations.

Move up a step from the UX-100 to the UX-170. Like the other model, the 170 carries speed transmission, halftone control, and fax/phone switchover. But it also features an automatic paper cutter which helps in busy fax transmission times. The UX-170 also gives a greater page feeding function, allowing you to load in ten pages automatically.

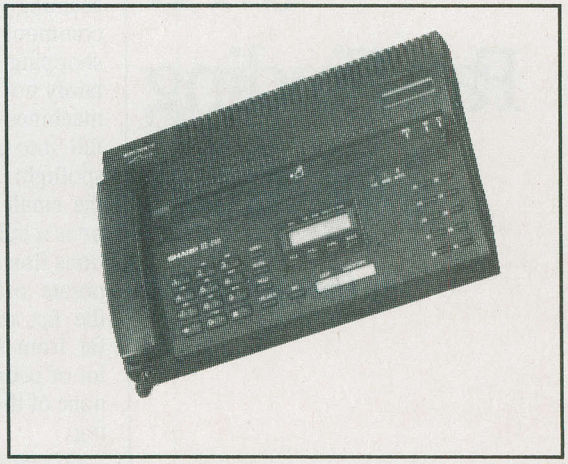
There's less number-crunching with the UX-170 too. The UX-170 features automatic dialing so that up to twenty numbers can be stored. That cuts down on wrong numbers and time spent punching numbers into faxs.

The UX-200 enhances all the features of the 170 and 100. Still compact in size, the UX-200 is widened slightly to compensate for a larger scanning area (10 inches) and a maximum transmitting document width of 11 inches. That allows for computer printouts without having to trim them down in size.

Up to 60 auto-dialing numbers are supplied with the UX-200 which make Fax transmission just about worry-free. Up to 10 frequently-called numbers can be stored in individual key strokes. For each number, an alternative number can be stored to be dialed if the first one is busy. If the second one is also busy, the first number is called two more times at five-minute intervals. An additional 50 numbers can be stored under two-keystroke commands. The telephone has 60 auto-dialing numbers as well, and a re-dialing function.

The UX-200 gives greater control over transmission which means faxing can be better planned to take advantage of cheaper long distance rates. By presetting the UX-200, the operator can be present or absent at times when Faxs are transmitted or received.

Finally, perhaps proving the UX-200's advanced phone features, the machine has a built-in answering machine for voice calls. The automatic switchover device allows the UX-200 to conveniently print fax transmissions, and record voice messages.



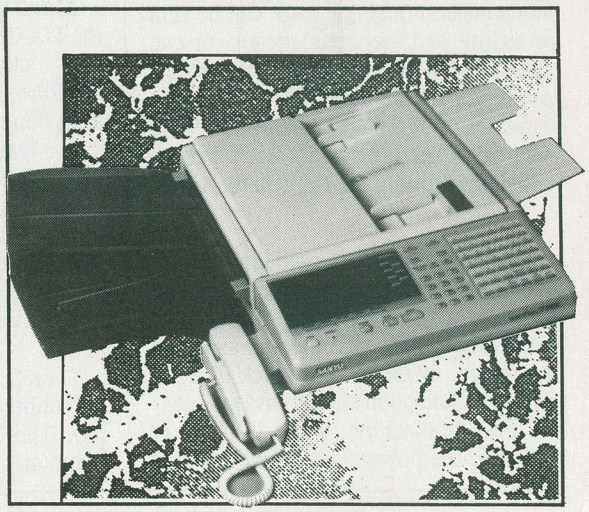
The Sharp line of fax machines, compact and full-featured, shouldn't be overlooked in any Fax search. Their resolution and halftone control make them perfect fax choices for the lower-volume user office or home business, and their advanced telephone features might make the separate telephone on the desktop with them, obsolete. ❐

Fax Focus

Embarking on a Fax-Finding Mission

by George Colpitts

Even a casual glance at the fax market reveals a rapidly expanding, complex — and yes, exciting — technology developing. As models increase in speed, decrease in size, and seemingly explode with communication capability, shopping for a fax has certainly not become dull. Fax machines by their very role fall into a bright business spotlight. Whether used by the small home enterprise, or as a hub for communications flowing through a corporate office, chances are the fax machine won't be far from sight, it'll have a lot of people around it, and none of them will be snoozing.



Of course, as exciting as fax use and models have become, it is no wonder that looking to buy a machine has become confusing. Transmission rates, document feeding, scanning capabilities, gray scaling, page sizes: ogy, multiple transmissions, orchestrated redials, etc. But don't be discouraged by the complexity of market prices, capabilities and features.

Begin any fax-finding mission by asking yourself a few questions and asking the salesperson a few more — then, decide which models and features to buy into.

Let's begin our mission with the most basic question. **How much will you use the machine?** Difficult question to answer? Sometimes it is. Even small businesses hope for expansion, and with expansion they see their fax requirements increasing. Some companies have shaped their models to compensate for this type of projection, giving surprisingly sophisticated features in lower- end models. But make no mistake: the best way to look for a machine is by knowing how much you will use it. If you're a smaller office, or even a home business which will receive and transmit only a few faxs a day, you might opt for portability. The fax that won't dominate a room, but will fit into the corner of a desk. Some smaller machines also feature advanced telephone capabilities so that phoning out, faxing in, and taping messages are handled by a machine only a few pounds in weight. Low-end machines can carry some pretty impressive features too. Most can switch automatically from fax mode to phone mode if a call comes through, and if you aren't there to pick up the receiver, the fax will relay a message to the caller.

Begin any FAX-finding mission by asking yourself a few questions and asking the salesperson a few more — then, decide which models and features to buy into.

most models have developed these basic features to varying degrees. That's not even talking about the mind boggling features of higher-end machines, such as plain paper technol-

Obviously, a heavier-use fax will have to carry additional features. Large paper trays or rolls, paper cutters, auto-

matic paper feeders, increased memory all become critical in a high end machine. Memory allows for substitute reception, broadcasting, send later, and batch transmission features. Some models, for instance, carry up to 73 pages as standard and can be expanded to hundreds of pages. That means those big jobs can be fed into the machine and left to process without you standing around reading a magazine. Memory also increases a fax's confidentiality, especially important for large offices with large fax use. You don't like people reading your mail; why should they be able to read through your faxs? There's a lot of features out on the market, then, most of which are built for specific volumes of use. Determine how much you'll use the machine early, and you're well on your way to getting the right model.

What Will the Machine be Used For?

Another basic question, but equally important. A small graphics firm will have different uses for faxed information than a company receiving bales of computer data. For instance, a company needing to send photos, artwork or layouts will be attracted to models offering superior resolution and grayscale interpretation from 16 to 64 shades. The 11 x 16 capabilities in some models would be of interest too. A company, however, requiring a portable, basic unit to send memos to sales agents in the field would be attracted to a completely different machine. What about those awkward, oversized computer printouts? You might get tired of trimming down pages before sending them and you'd probably want to look at models with wider scanning widths and paper intake.

Again, by determining exactly how the machine will be used within a company, the potential fax buyer can narrow down the many models to choose from.

What Extra Features Do You Want?

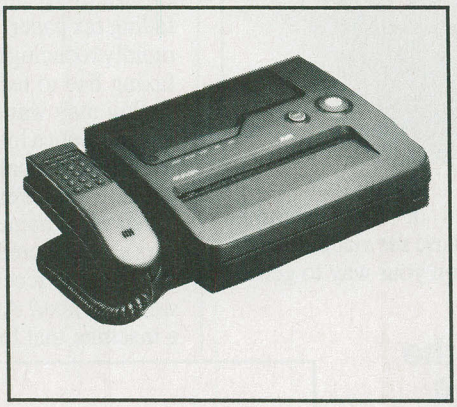
Related to the previous question, this one is also important. Will you be storing faxs for any period of time? Plain paper technology, although more pricey, might be a consideration so you can archive plain paper instead of curly, fading fax paper. A lot of companies are rapidly reducing the price of plain paper faxing due to technological innovation so you may want to consider this area. Do you want a lot of redial and automatic dialing capability? Some models develop this feature greatly so that hundreds of names, addresses and numbers can be stored right on the machine. Will you be receiving a lot of night or weekend faxs? And if so, will you want a machine that features backup in case it runs out of paper? With the wide range of models available, you'll find that some machines can offer you a sampling of basic features *and* supply you with the specific features your business requires. Maybe worse than buying a machine that doesn't keep up to your fax requirements, is paying for a lot for features you'll never use.

The fax-finding mission, then, begins by assessing what your business does, and how you will communicate with other businesses more effectively by using fax technology. After that, get ready to explore the rapidly growing, and exciting, world of faxs. ❐

Beamscope

Beamscope distributes a wide range of high technology items, and a comprehensive sampling of Murata Fax machines.

The Murata M900 is the first in a series of Murata products specifically designed for the low-volume office or home business. Whether a corner suite downtown, a spare bedroom or somewhere on the road, the M900 offers higher-quality Fax and voice communication at a low-end price. The emphasis is on size and performance: big Fax features in a powerful and versatile unit that's smaller than an in/out box.



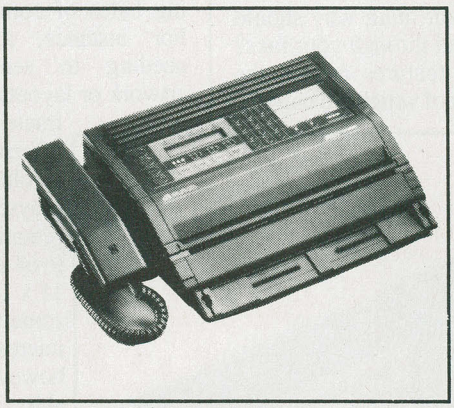
Small businesses may be most attracted to Murata's triple functions of a Fax, phone and copier, all in one. Ever phone a Fax? The M900's operates on standard phone lines. With its autodialer, hold and redial features, and a handset that provides voice transmission, the M900 is a full functioning telephone. A built-in voice prompt responds to incoming calls when the business owner is absent, telling the caller that the line was answered by the M900. That, while allowing incoming Fax messages to be received and printed. Among other benefits, the feature means the small business doesn't need the added costs of a dedicated fax line.

The M900 also features a built-in speaker which makes on-hook dialing easy for your fax and phone calls. The machine has 20 speed-dial numbers and one-touch keys which can store up to 21 digits each, a feature to cut down on headaches from punching out long, international numbers. Long-distance service code numbers can be stored also.

More executive features can be found in the next model up from the M900: the M1100. Still intended for office and in-home use, the M1100 features an automatic paper cutter, eliminating rolled up and confusing bales of transmissions on the office floor. The phone features of the M1100 are enhanced too. You can use another phone with the machine by plugging the second phone, even a cordless, into the M1100. By setting the M1100 on manual reception, a telephone answering machine can be plugged into the unit.

The big step up comes with the M1400 aimed at the growing business, having both Group 3 and Group 2 compatibility for global communications and surprising high-end features at the still low-end price.

The M1400 features a higher quality transmission, with 16-level grayscale to accurately transmit photographs and other halftone images. No more blotches of black and areas of white on snapshots. The machine also features a normal and fine transmission mode to speed up transmission on typed documents when grayscale is not a factor.



You might notice the 5-page feeder accepts documents up to 11 inches wide on this machine. The M1400 will automatically reduce over-sized documents to 8.5 inches wide during transmission, a feature normally found on high-end Fax machines.

An expanded automatic dialing memory allows up to 100 numbers in the autodialer. Fifteen one-touch keys and 85 speed-dial numbers are available to speed up the most tedious part of Fax transmission. Moreover, the built-in monitor speaker lets you dial calls while you work.

With the M1400, the user can better control the timing and costs of transmission. A delayed dialing feature means a Fax can be put into the machine and transmitted after hours, when phone rates are lower. A tracking feature creates a journal summarizing Fax usage, transmission and reception length, number of pages sent, time, date and result for the 25 most recent Fax transactions. And the M1400 tells you if your transmission was received, taking away any lingering doubt left after transmitting an important document.

The M1400 has an impressive service feature too: Murata can test your Fax by computer, over the phone to resolve most problems.

The M1800 features executive business Faxing with boosted memory — 16-pages of memory. SecureMail transmission and reception, sequential transmission to many locations and delayed transmission from memory are some of the M1800 features. Extra memory opens up advanced possibilities: The M1800 carries five special programmable keys to save time making Fax commands. And the machine's multitasking function allows it to juggle incoming and outgoing transmissions. Finally, added machine memory means you can afford to be a little more forgetful: if your M1800 runs out of paper, incoming messages are automatically stored.

As a complement to the M1800, the M1850 has all these features with an added automatic paper cutter — always a convenience — and a large-capacity paper roll of 164 feet.

Chances are, one of Beamscope's wide range of Murata Fax machines will suit your business needs, whether you're shopping for a small home business, or a bustling downtown office. ❐

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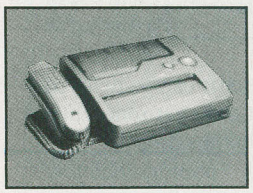
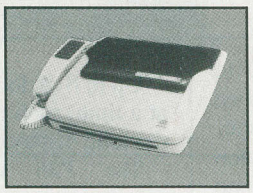
M900



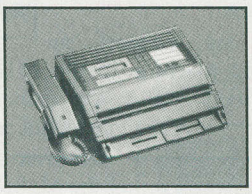
The Executive Fax . . .
At Home. At Work. Anywhere.

M1100



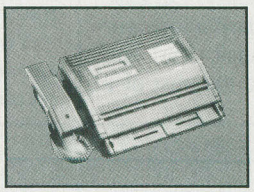
The Affordable Fax . . .
With An Automatic Paper Cutter.

M1400



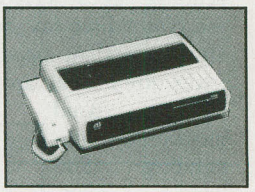
The Executive Fax . . .
For the Small-Office Professional.

M1800



The Executive Business Fax . . .
With Memory.

M1850



The Big Business Fax . . .
With Automatic Paper Cutter.

The Murata line of facsimile machines can make a worthy addition to your store's product mix. Murata provides the customer with All the right features: compact design, simple operation, and sophisticated communications capabilities at a real-world price. Perfect for any home or office. From Beamscope, Canada's leading supplier of entertainment software and video games, as well as a complete line of home office products featuring: Star Micronics, Anchor Automation, Mylex, Sharp, Toshiba and, now, MURATA.

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Gestetner

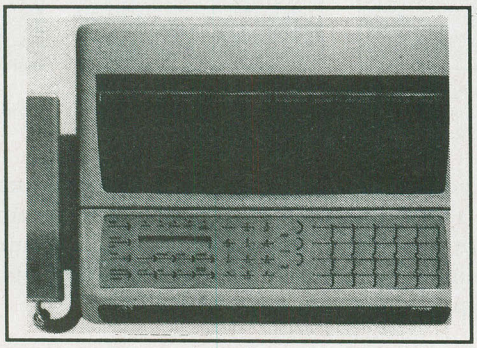
Gestetner handles the Murata Fax line of machines in Canada. The simple and cost effective "M" series offers powerful fax facilities for home office applications. The more sophisticated "F" series machines can keep up with the best of them in a business environment.

The high end "F" series machines reflect the growing trend toward connectivity, with fax becoming just one element in the application of microcomputers to business. As we'll see, the powerful Murata business fax machines allow you to make the best use of both your fax and your computers.

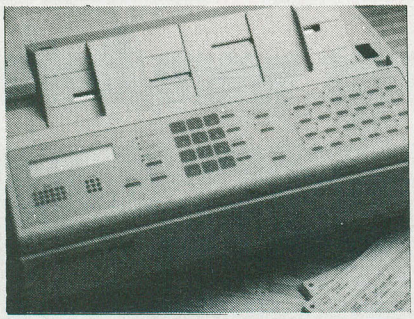
Personal Fax

The Murata M900 is a small, elegantly simple fax machine for users who have no requirements beyond the sending and receiving of small fax documents. Like most low priced personal fax machines, it can serve as a phone and as a photocopier as well. Naturally, it photocopies onto fax paper, which is unlikely to make you want to trash your plain paper copier if you have one.

Unlike many low priced fax machines, the M900 features a full 9600 baud modem, making it capable of sending pages fairly quickly. Because the group three fax standard allows for slower modem baud rates, low end faxes often sneak around the cost of a 9600 baud modem by substituting 4800 baud communications instead. If you'll be sending faxes by long distance, the savings involved in buying a lesser machine with a slower modem will quickly vanish.



Another feature of the M900 which is by no means standard on low end fax machines is its ability to send higher resolution documents. If you have an original with fine print on it, you can switch to its higher resolution mode to make sure the fax you send will arrive readable.



The simplicity of the M900 will make it suitable for use by anyone who can operate its two simple controls — conveniently labelled "start" and "stop."

The Murata M1850 is anything but simple — it's packed with features. It can store up to fifty phone numbers for instant autodialing. It has a built-in digital speech synthesizer, so that if a human calls it the machine can say that it's a fax. The M1850 includes a single line facility, such that it will automatically switch from fax to voice mode, depending upon whether its caller is thinking with neurons or transistors.

You can connect an answering machine to the M1850 to record incoming voice calls when you're not around.

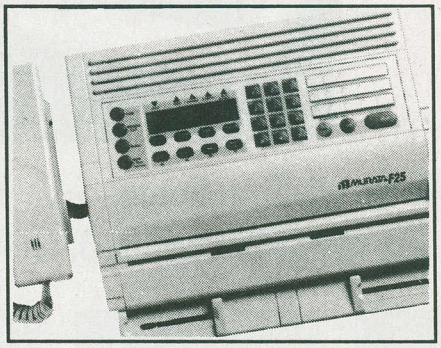
The fax section of the M1850 is no less interesting. It can broadcast fax documents, delaying them until the long distance charges go down. It will handle up to sixteen shades of grey and has three resolution settings to handle even the tiniest print.

One of the unique aspects of the M1850 is its remote diagnostic and repair facilities. If your M1850 starts to misbehave, Murata can call it, diagnose its problems over the phone and frequently do the repairs remotely as well.

The M1850 features a document cutter so you get pages rather than a scroll of fax paper. It will number the pages and print an activity journal for you. It has a built-in LCD display to let you keep track of what it's up to. Like the M900, it will serve as a phone and a copier too.

Business Fax

The Murata F25 has a good mix of features if you're after a mid-range fax — plus a few that you probably wouldn't expect. It has a one hundred number phone dialer, just the thing for the intensely popular. It has a network facility which will allow you and other users of Murata Fax machines to send secure faxes, such that no one not part of the network can access your machine. The network facility allows the F25 to call other machines and retrieve documents from their memory. This allows you to make more efficient use of a busy fax line.



Up to five documents can be delayed at a time, such that they get sent when the long distance charges drop.

The F25 will photographically reduce large documents for transmission. Its sixteen grey level scanner will handle photographs with excellent results. It has an answering machine connection and automatic voice switching so you can use a single phone line for voice and fax calls.

The F25 features an internal memory which will hold up to sixteen pages.

The Murata fax machines from Gestetner are certainly prime contenders for most fax applications. Their low end faxes have many useful features, some of which are not on similarly priced units from other manufacturers. Their high end machines have a decidedly rich mix of features. ❐

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Canon

Canon Canada Inc. added new players to its team of FAX machines this last year, enhancing both its personal and business offerings.

In August, Canon introduced the Faxphone 15CD and Faxphone 26 models, both boosting features available in its personal/business line. The 15CD has a built-in data bank and features a five-page automatic document feeder, automatic dialing and receiving, a copy function, transmission speed of 30 seconds per page, monitor speaker, fine mode, on-hook dialing, an activity report and last-number redialing.

The Faxphone 15CD provides thermal printing with a resolution of 98 lines x 203 pels in standard mode, and 196 lines x 203 pels in find mode. The unit's data bank provides the capability to program a telephone directory to approximately 150 locations and a calendar for approximately 150 appointments, in addition to calculator functions. "Users can automatically dial the numbers stored in the data bank's directory dialing list either when sending documents or making telephone calls, providing greater speed and convenience when communicating with frequently called numbers." said Jun Iwasaki, Director, Reprographic Products Group. "It is like having a telephone book attached to the fax."

The Faxphone 15CD can handle documents ranging from 5 7/8 inches wide to 8 1/2 inches wide. It has an effective scanning and recording width of 8 1/16 inches. Its modem speed ranges from 2,400 bps to 9600 bps.

In August, Canon Canada Inc. introduced the Faxphone 26, featuring automatic dialing to 65 locations, a 15-page automatic document feeder and high-speed transmission. The Faxphone 26 can also be hooked up to a personal computer.

The Faxphone 26 has an automatic FAX/TEL switch-over feature which assures reception of both telephone calls and facsimile transmissions with this model, which can receive up to seven pages in memory.

Capable of transmitting as fast as 12 seconds per page, the Faxphone 26 also features a relay broadcast command, sequential broadcast to up to 16 locations, and transmission to a confidential mailbox. G3 compatible, it has an optional RS-232C interface and provides an activity report.

Other functions include automatic redialing, automatic paper cutter and automatic reception. A convenient local copy function permits reproduction of up to 30 copies of a document. The Faxphone 26 has a 20-digit, two-line liquid crystal display (LCD).

The Canon FAX-L770 plain paper laser fax employs the company's Laser Beam Printer (LBP) technology that is the standard for the industry. The new FAX-L770 features an enhanced version of Canon's UHQ technology, high resolution hypersmoothing that delivers an image quality close to the original, an exclusive all-in-one compact replacement cartridge system that increases reliability and maintains optimum copy quality and an optional FS-232C port that integrates computer and fax functions.

The Canon FAX-L770 transmits a letter-sized document in just 9 seconds and has a high-speed printing capability of 4 pages per minute. Boasting a high resolution of 200 x 400 dpi in the SUPER FINE mode, the FAX-L770 scans and transmits text, illustrations, and photographs in up to 64 shades of gray.

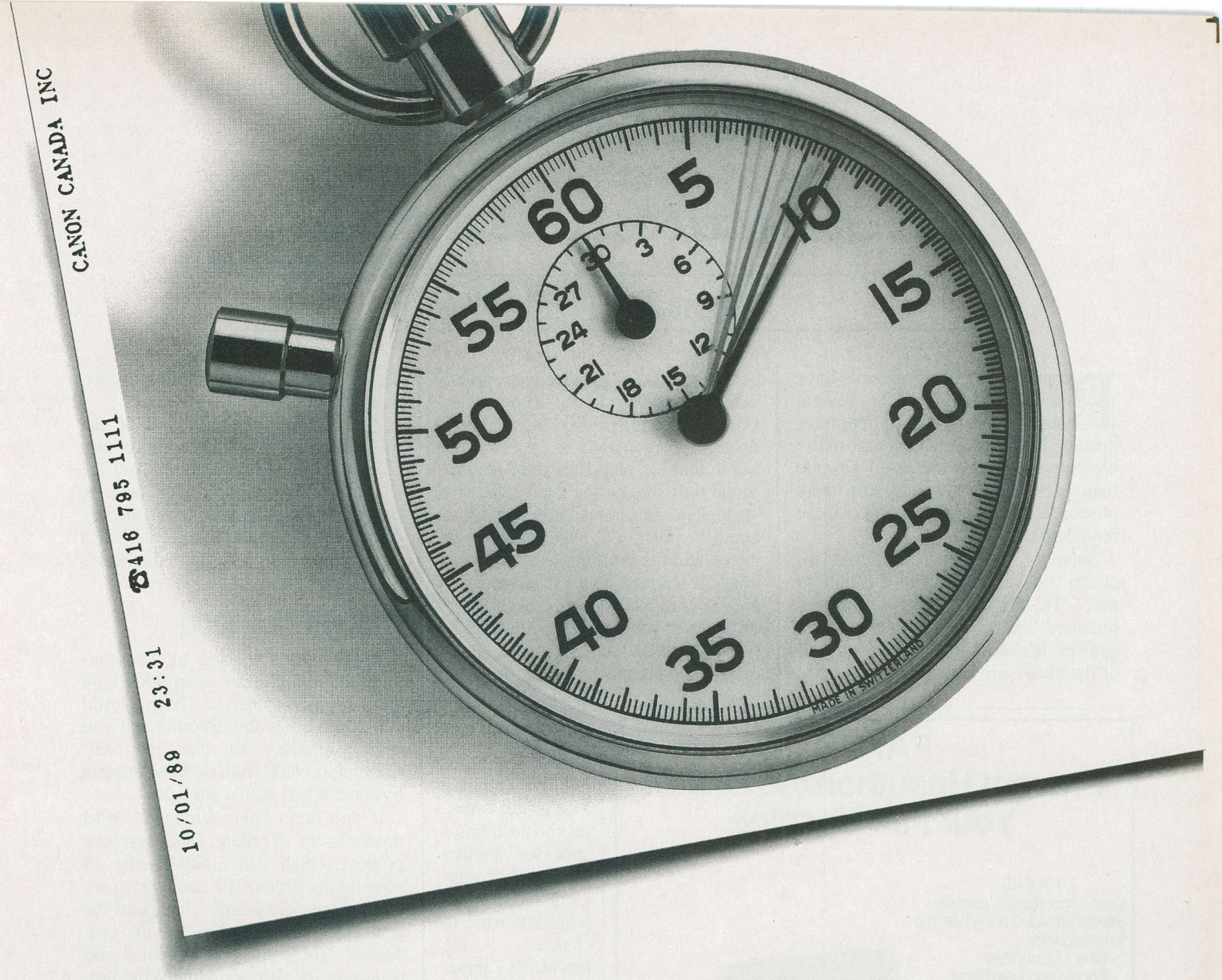
With LBP technology and Canon's advanced UHQ and hypersmoothing technologies, the FAX-L770 delivers the most advanced image reproduction of unprecedented depth and clarity on both the receiving and transmitting end. An Edge Enhancement feature in UHQ eliminates the fuzzy look often appearing on transmitted text, graphics, and illustrations, and its Error Diffusion method provides more depth and clarity of halftones. Canon's patented Hypersmoothing process uses a custom-designed LSI (Large-Scale Integration) circuit to adjust incoming document images by filling in rough images and text for a more solid look.

Due to canon's laser technology, the FAX-L770 incorporates newly-designed components that result in an ultra-compact high-performance facsimile. The replacement cartridge unit includes the drum, toner, and developer which can be replaced simply and quickly. A lensless contact image sensor scanning system increases sensitivity by directly reading the original for better image quality. The absence of internal mirrors traditionally used to scan materials and Canon's compact LBP engine, found in its latest laser beam printer, result in an ultra-compact design.

The Canon FAX-L770 has Automatic Speed Dialing for up to 172 different fax numbers, including 10 coded speed-dial numbers and 72 one-touch speed-dial numbers. To speed up the fax process, Canon's exclusive InstaScan scans and stores documents into memory at 5 seconds per page. Dual access, in conjunction with InstaScan, allows the user to perform one function while the FAX-L770 is processing another function. With the transmission reservation feature, the user can store up to 32 jobs in memory which is automatically transmitted when the machine is free.

Other features of the FAX-L770 include automatic redial, automatic background control to compensate for coloured originals, density control, sequential broadcast and delayed transmission to as many as 188 locations at 32 different times, group dialing, memory polling, relay broadcast command, batch transmission, and memory reception.

The FAX-L770 accepts letter- and legal-sized documents and includes a 250-sheet cassette and 50-sheet paper tray. ❐



In business, time is money. The transmission speed of a Canon Fax can save you both.

Canon facsimiles are dedicated to speed. Every second of transmission time means money, and if your business depends on high volume, long distance faxing, every fraction of a second adds up to big savings.

The Canon line includes the world's fastest G3 facsimile, the Canon Fax-850 at a mere 6 seconds a page.* With Ultra High Quality image processing and a host of other high efficiency, high performance features, Canon facsimiles are as smart as they are fast.

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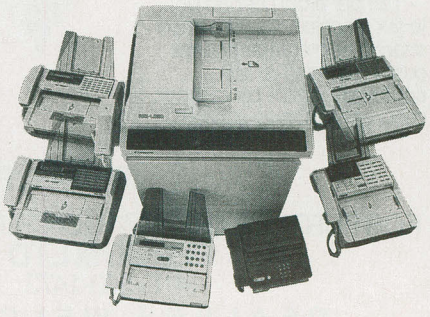

Canon FAX

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*Based on CCITT chart #1.

Fax Boards

GFM Microdata Systems Inc.

Faxing... Easy As Printing

Personal computer fax cards have now been around for several years. However, their prices have drastically dropped and their ease of use has correspondingly increased. Despite their prevalence, there are still many misconceptions regarding these remarkable devices.

Some of these misconceptions include: "PC fax cards are difficult to use," "PC fax cards always require a scanner," "PC fax cards are expensive," and "PC fax cards are not efficient." **All of the above are untrue!**

Indeed, PC fax provides several advantages over standalone fax machines. Convenience is a primary one. Faxing a document is generally as easy as printing it, and fax boards provide features found only among the most expensive standalone machines. Fax quality is another plus. PC fax avoids the degradation that often occurs when an image is scanned, so the faxes you send are easier to read. Most faxes probably originate in your computer anyway. So when you print your document, take it over to the fax machine, feed it in and send it, the quality just has to suffer. Finally, PC fax boards save space and maintenance headaches — the re's no need find a spot for another piece of equipment and then appoint someone to change the machine's paper or distribute faxes.

When it comes to computers, many people have a mental block. As soon as they hear the word "computer," the word "complicated" automatically enters their heads. PC fax cards are often perceived to be complicated to use. In reality, a standalone fax machine contains the same components as a fax card and computer: a dedicated scanner, a printer and memory.

A high-end standalone machine can be far more complicated than a fax card if it has many extra features. And PC fax cards are more economical because they make use of features which already exist in the computer. By contrast, a standalone fax machine duplicates functions in the PC.

CompuFax-9600

When it comes to ease of use, convenience and systems integration, you can't beat computer fax boards. Add Windows 3.0 to this formula and you have a product that can't be beat! CompuFax-9600 from GFM Microdata Systems is just such a product.

If you don't have Windows, GFM produces an excellent DOS software product which will easily handle all your faxing needs. The opening screen is simple and easy to use. Just press the appropriate function key for the task desired. The display is graphical and pleasing, slightly resembling Windows.

Both the DOS and Windows version of the program include an easily accessible phone book, an activity log and a feature to allow you to fax documents at a later time (such as at night when the phone rates are lower).

The Window's version of CompuFAX-9600 software works equally as smooth. To send a fax, just print using the installed CompuFAX-9600 printer driver. Your document will not print on your printer, but will be faxed to its proper destination.

All in all, including one of GFM's fax cards and either the DOS or Windows based software will allow you to greatly increase your productivity and gain complete control over any and all of your faxing needs. ❐

FAX - S
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FAX - S
Cost accounting & security device provides a log with the following info
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- Phone number dialed
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- Unauthorized call attempts

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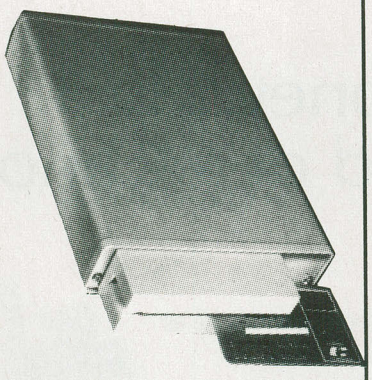

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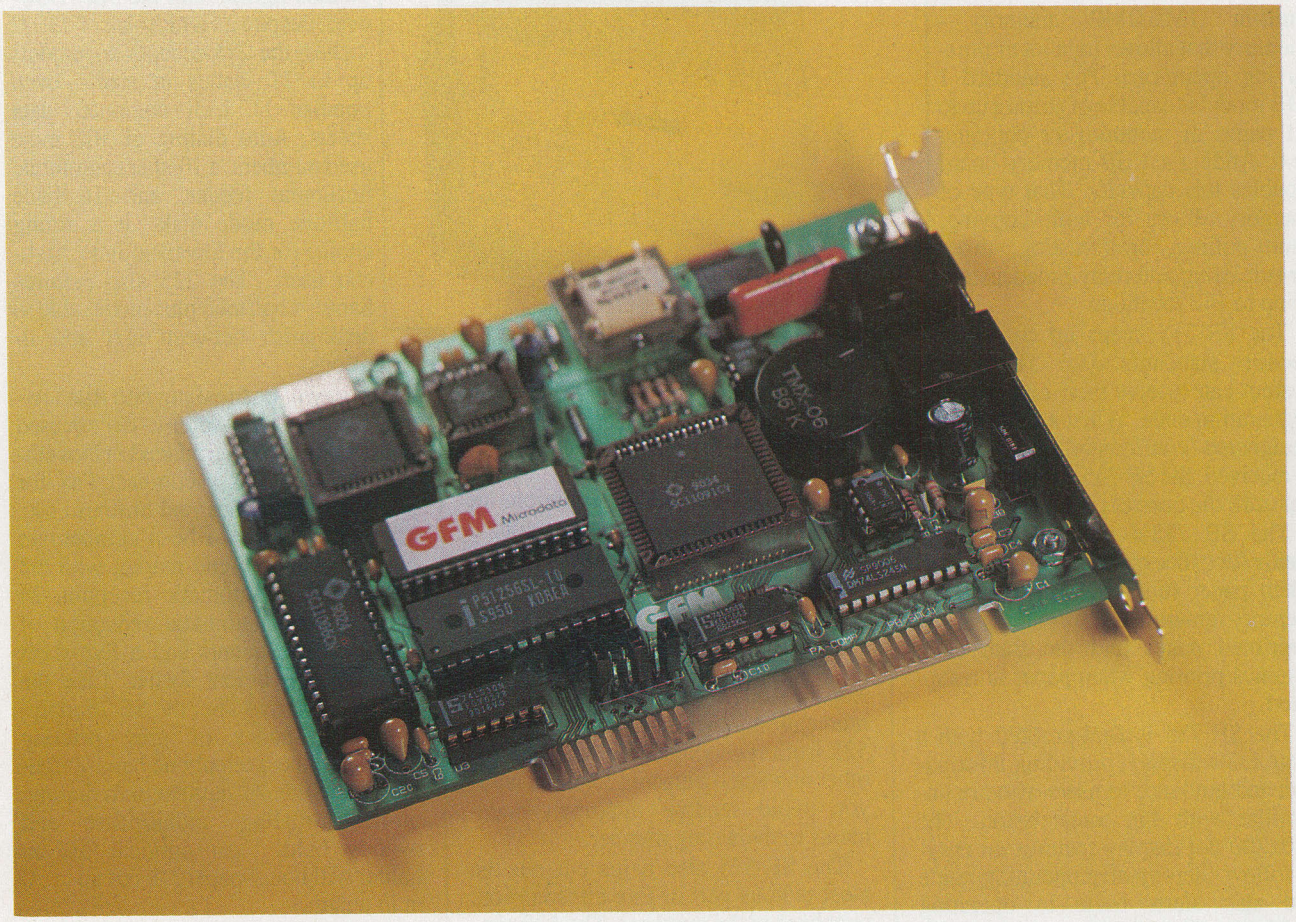

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Circle No. 88 on Reader Service Card

Sanyo

With one of the most comprehensive feature lines available, and more models in development, Sanyo can't be overlooked in a fax finding mission. Whether attracted to the high end, SF 735 (featured on the cover), or the SF 75 to be available at the beginning of November, Sanyo machines can offer many fax answers for the corporate and household fax user.

The Sanfax 735 is designed, as most Sanyo products, to reduce time-consuming procedures and as a by-product, to prevent the mess and stress often associated with corporate transmissions.

The SF 735 can act as a "hub" for a corporate Fax network with its built-in 1MB/2MB memory — memory that allows for a lot of time-saving operations. The standard 1 MB model is capable of storing up to 71 pages of incoming or outgoing text. Adding a 1MB memory board doubles this capacity. That type of memory allows for multi-copying, multi-polling, broadcasting, timer broadcasting and relay broadcasting to up to 142 locations.

The SF 735 keeps up corporate security standards also. Users in the system can receive their own personal registration code. When a transmission designated 'confidential' by the sender is received, the SF 735 will delay printing until the correct code is input.

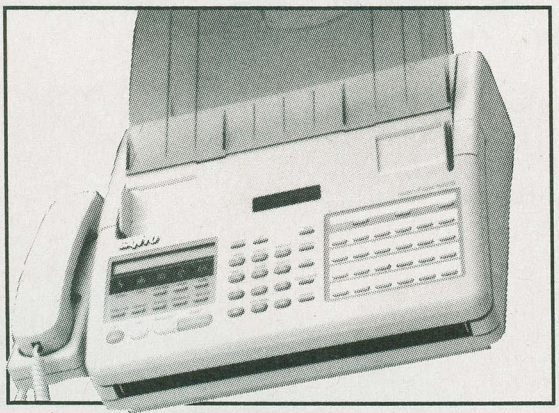
The SF 735's memory comes in handy for office oversights also, such as when paper runs out. The machine's memory remembers the contents of any unprinted pages and the transceiver resumes printing when paper is resupplied.

The SF 735 is fool-proofed with a large LCD display, providing information and guidance to users who are unfamiliar with fax transmission. The 320x200 dot display features an easy-to-follow, step-by-step operating guide and also alerts users to operating problems. The display also tells the operator whether the fax was received — doing away with the need to phone to find out.

Resolution is a big feature of the SF 735. In Superfine Mode, the machine scans at 8 pels x 15.4 lines/mm, four times the standard mode resolution. Fine text and charts, then, are read instead of thrown away at the receiving end. A 16-shade halftone reproduction allows for the transmission of pictures and photographs and the machine automatically distinguishes between text and illustrations.

Moving down a step, the Sanfax 525 still maintains a strong performance for high end fax needs.

The SF 525's memory is more downsized from the 735, having a 256 KB built-in capability to store 15 pages of text, pictures or graphics. Expansion can build that up to 30 pages. Memory



is the SF 525's biggest drawing card, and can be used flexibly according to user needs. Outgoing documents can be memorized for transmission or broadcast to up to 100 locations.

Again, confidential transmissions are held until a personal registration code is input. Moreover, a phone security lock restricts use and eliminates abuse of your phone by not allowing outgoing calls unless they're proceeded by a private 4-digit ID number. Security can stop waste. A closed network communication function prevents the SF 525 from receiving junk Fax mail and other unwanted transmissions and helps you avoid sending important documents to the wrong number.

The SF 525 also helps cut out the most tedious part of Fax transmission: punching in the numbers. The 525 contains an automatic dialing feature — with 24 one-touch auto dialing and 76 speed dialing buttons, each one of which can be programmed to call any desired local or international number.

If you're a smaller-volume, high-end user, you might consider the Sanfax 520. The SF 520 features the capabilities of the more heavy-hitting Sanyo products, without the elephant-sized memory. Included is the 30-page automatic document feeder for no-worry transmission. The speed dialing features are included and transmissions can be sent using the Standard, Fine and Superfine resolution levels. Paper is cut automatically in the SF 520, trimming the size to match the size of the original sent and eliminating paper waste.

Closely related is the SF 225 a smaller Fax with many high-end features. The 225 is about half the weight of the 735, and about four pounds lighter than the 520. However, despite its width size of 13 1/2 inches, the 225 accepts documents up to 11 inches in size — even popular 11 inch computer data sheets. Auto dialing of 100 most used numbers, a 10-sheet automatic document feeder, and 16-shade halftone mode make it a strong choice for the lower-volume, high-end user. The 225 also features Sanyo's halftone plus mode, able to distinguish between text and illustrations.

Sanyo will be breaking into true low-end use with the soon-to-be released Sanfax 75. To be introduced in November, the SF 75 is a compact Fax for home, private office and business use. The 75 promises to be a competitive player in the low-end market with G3 compatibility, automatic reception 24 hours a day, automatic reduction of oversized documents and a five-sheet automatic document feeder. Like the rest of the Sanyo line, the SF 75 maintains 16 shades of grey printing capability and a telephone handset feature to include 20-number auto dialing, on-hook dialing, redial/pause and melody hold. An optional add-on holder will house paper rolls of up to 50 m in length.

Any Fax-finding mission would have to include Sanyo and its comprehensive line of machines. Especially suitable for the high-end users, Sanyo products, with the introduction of the SF-75, will also meet the needs of the home user. ❐

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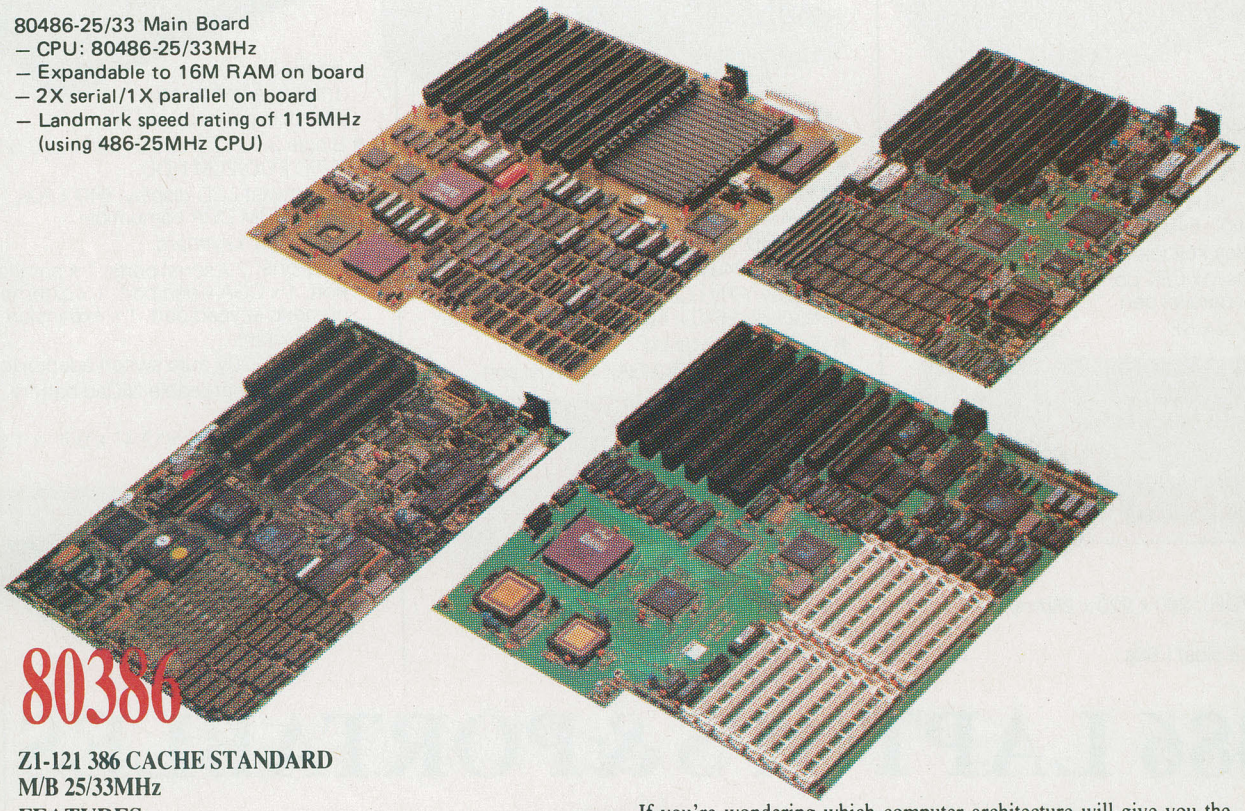

80386

Z1-121 386 CACHE STANDARD M/B 25/33MHz

FEATURES:

The 386 CACHE STANDARD M/B 25/33MHz are as follows with all features applicable to both models unless otherwise stated:

* Intel 33MHz 80386-33 CPU.
* Intel 25MHz 80386-25 CPU.
* Socket for 80387-33 math coprocessor.
* AMI BIOS with built-in setup program and diagnostics.
* Room for 8M of memory on board.
* Memory page interleaving for faster data throughput.
* Seven 16-bit (AT) expansion slots and one 32-bit memory expansion slot.
* Real time clock with battery backup CMOS memory.
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* Full support for all MS-DOS and OS/2 applications.

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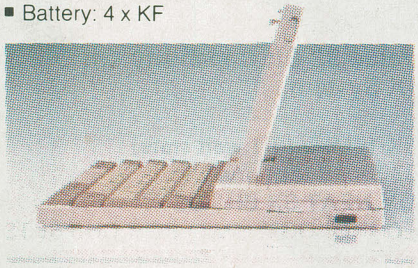
- Display: FTN LCD display, Graphics-CGA, Resolution-640 x 200
- 79/80-key keyboard
- I/O Ports: 1x CRT port (CGA), 1x serial port, 1x parallel port
- Battery: 4 x KF



- Size (WDH): 280 x 220 x 28mm/11″ x 8.7″ x 1.1″
- Weight 3.5lbs/1.6kg

286 Notebook Computer Only 7 lbs/3.2kg

- 80C286-12
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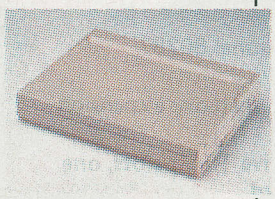

- Size (WDH): 280 x 220 x 50 mm/11″ x 8.7″ x 2.0″
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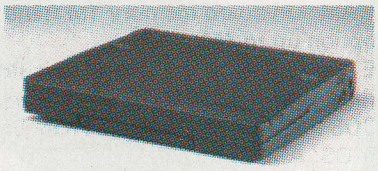

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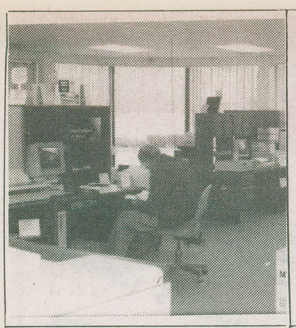
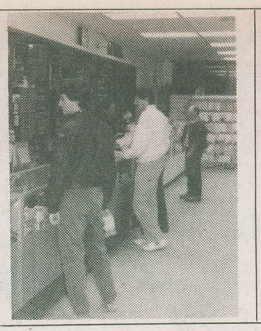
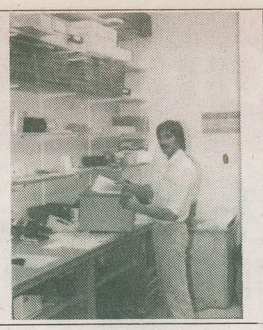
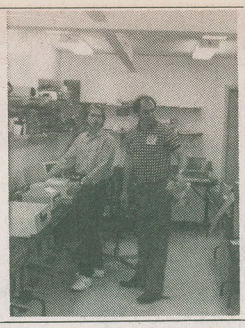

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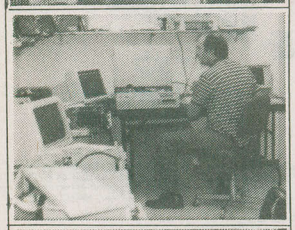

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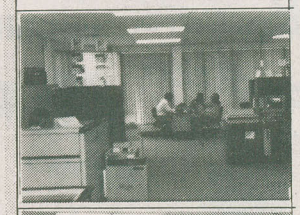

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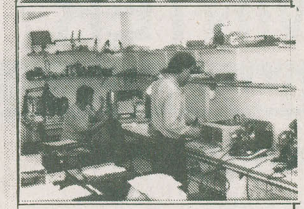

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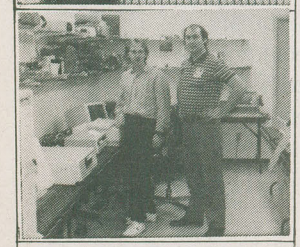

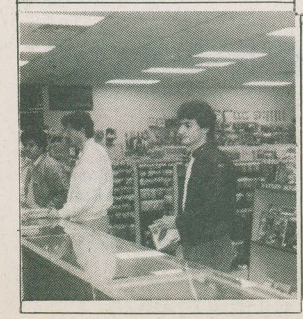

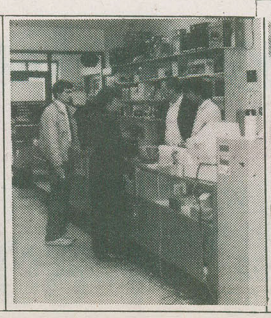

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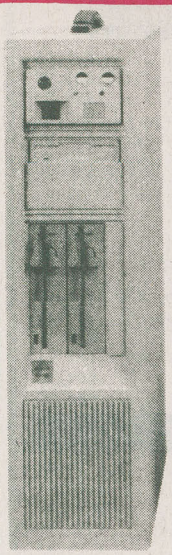

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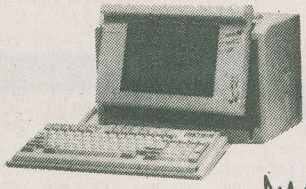

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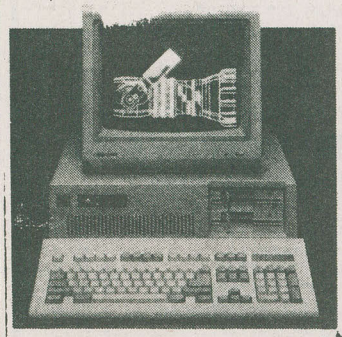

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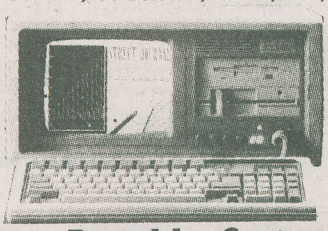

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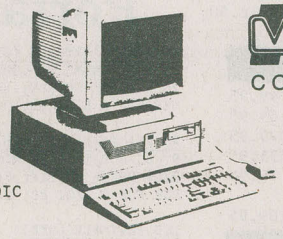

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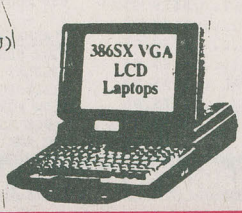

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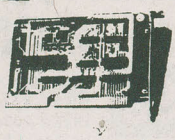

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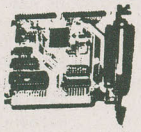

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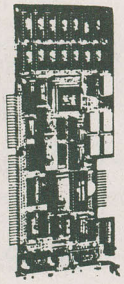

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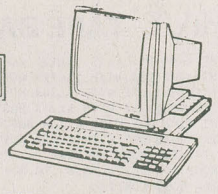

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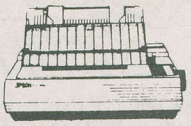

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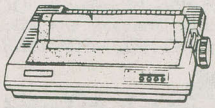

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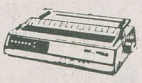

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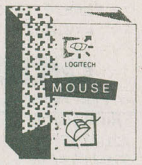

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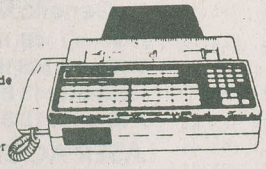

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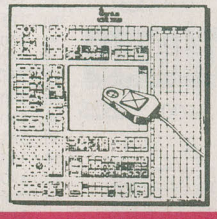

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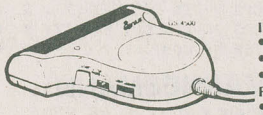

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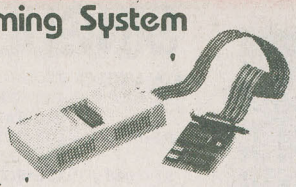

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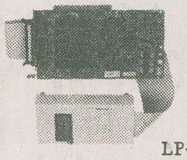

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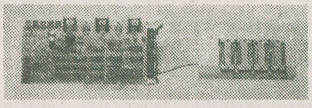

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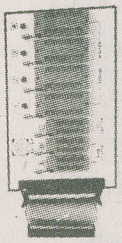

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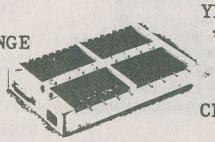

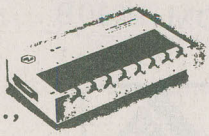

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CLK-2400	100MHz 25KHz to 25MHz	Channel 0-5 Channel 0-23	4K 1K	12KΩ <15P	1 Sets -10V to 10V	1 Channel 0-25MHz	1 Level "0", "1", "x" 100MHz "0", "1" only	1 Channel "1"	±25V	Card

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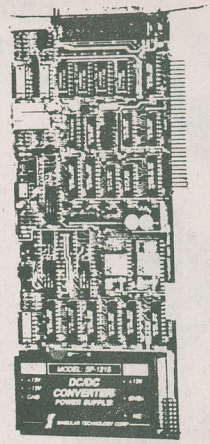

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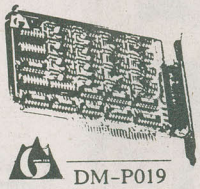

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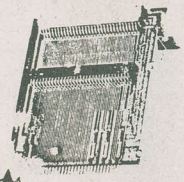

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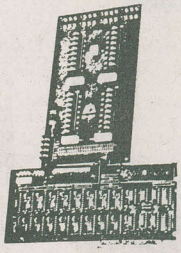

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AR-B 2011	PHOTO COUPLE INPUT MODULE	
AR-B 2102	SPST REED RELAY OUTPUT CARD	
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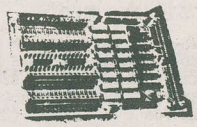
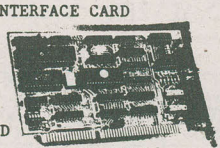
AR-B 3001	A/D CONVERTER CARD	
AR-B 2001	PHOTO COUPLE ISOLATION INPUT CARD	



PCM-8032



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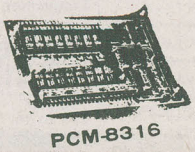

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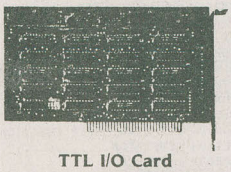
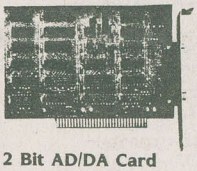
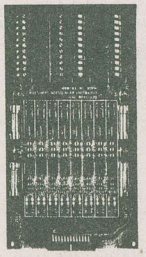


TTL I/O Card

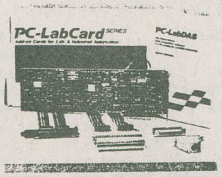


12 Bit AD/DA Card

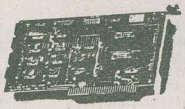


AD/DA Terminal Board

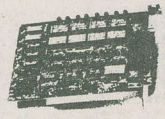
Data Acquisition & Control Test & Measurement Industrial & Lab. Automation



PCL-718 High Performance Data Acquisition Card



PCL-830
10 Channel Counter /Timer Card



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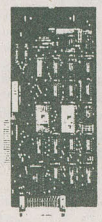

FPC-010
PC ADDA-12 CARD

PC INTERFACE

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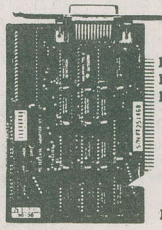

FPC-030A
PC IEEE 488
ADAPTER V2.0
(GPIB INTERFACE)

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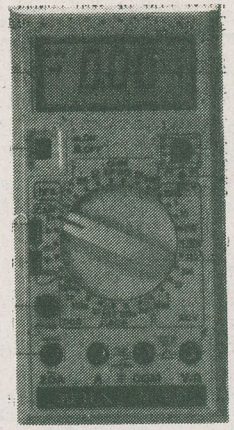

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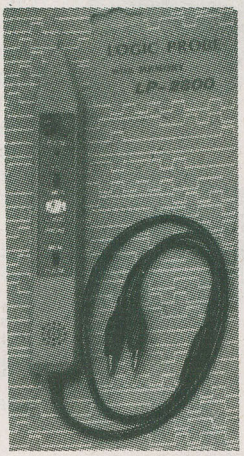

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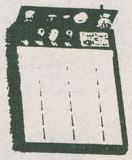

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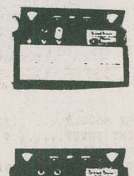

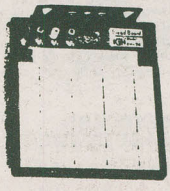

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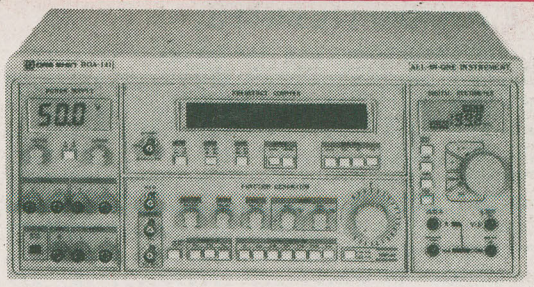

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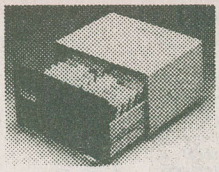

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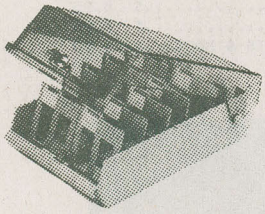

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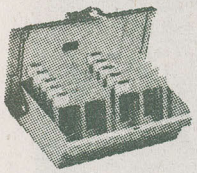

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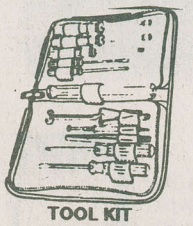
AS2420	24 X 20 (IBM - XT)	$ 42.50
AS2722	27 X 22 (IBM - AT)	$ 49.95

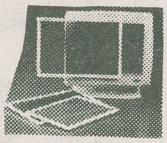


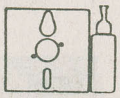
TOOL KIT

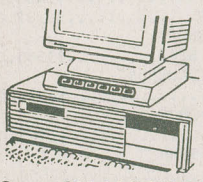
COMPUTER MONITOR TILT N' SWIVEL

MONITOR TILT & SWIVEL STANDS

S5010	12" MONITOR TILT & SWIVEL STAND	$ 14.95
S5014	14" MONITOR TILT & SWIVEL STAND	$ 17.95







Surge Shield CONTROL CENTRE

MONITOR TILT 'N TURN SWIVEL

KEYBOARD STORAGE DRAWER

ANTI-GLARE FILTERS

A12C/A14C	UNIVERSAL ANTI-GLARE FILTER (12" OR 14")	$22.50
A10XX	ANTI-GLARE (7 SIZES AVAILABLE)	$22.50

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MPD101	MOUSE PAD VINYL TOP	$ 7.50
AC0151	MOUSE POCKETS	$ 7.50
AC0150	MOUSE PAD - ANTI-STATIC	$14.95
AC0060	MOUSE STAGE - MOUSE PLATFORM FITS OVER KEYBD, SAVES DESK SPACE	$14.95
MPD102	MOUSE PAD CLOTH TOP	$ 6.50
AC0030	RIPPER STRIPPER	$ 8.95
AC0040	FORMS ORGANIZER	$29.95

COMPUTER DUST COVERS

DUST COVERS

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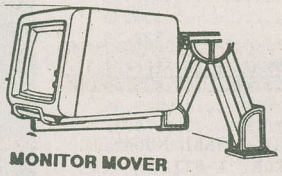
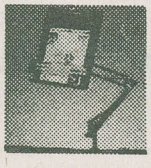
DC0020	AT 2PCS	$19.95
DC0030	101 KEYBOARD	$ 8.95
DC0040	MONITOR - 14"	$16.50
DC0080	MONITOR - 19"	$17.50
DC0060	132 COL. PRINTER	$17.50
DC0070	80 COL. PRINTER	$14.95
CXXXX	COMPUTER & KEYBOARD COVER	$17.50
C50XX	PRINTER COVER	$14.95



MONITOR MOVER



COMPUTER TOOL KITS

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AC0175	MONITOR COPY HOLDER-DUAL ARM	$19.95
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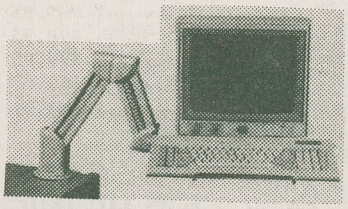
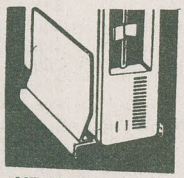
	ARCHIVE STREAMER HEAD CLEANER	$49.95
	DISK KNOTCHER	$ 7.50
	DISKETTE BINDER PAGE (4 DISKS)	$ 1.75

DELUXE MONITOR MOVER



COMPUTER FLOOR STAND



VERTICAL CPU STAND

MONITOR MOVER/CPU

ST2000	ATLAS ARM TRIDIMENSIONAL	$169.95
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ST500	ATLAS ARM EXTENDER CLAMP	$ 22.50
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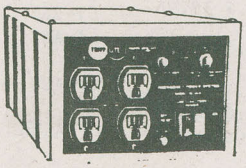

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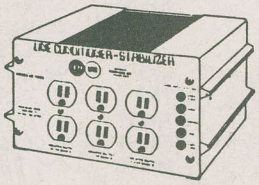

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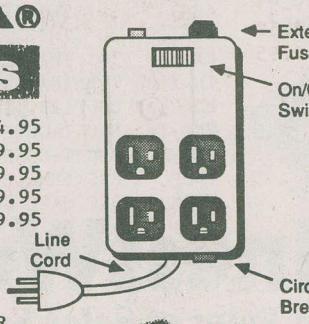

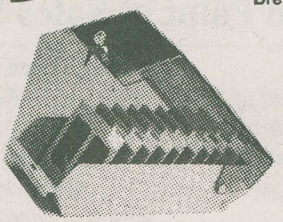

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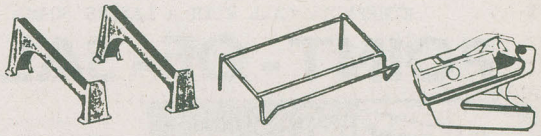

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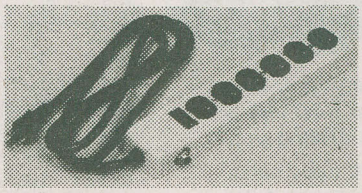

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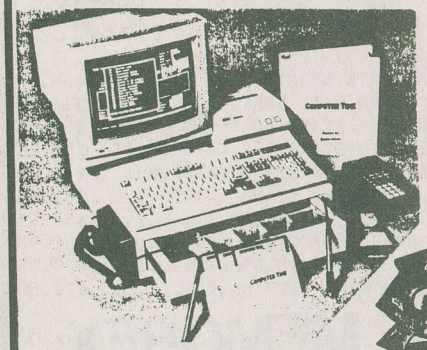

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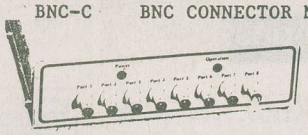

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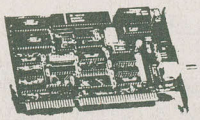

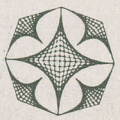

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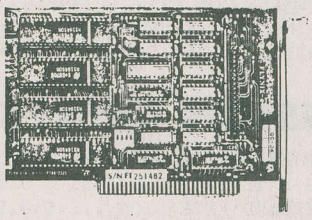
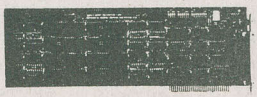
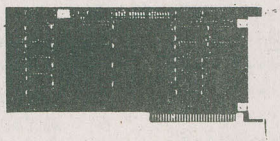
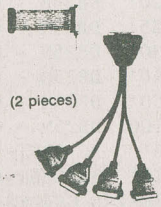






8 PORT RS-232 (Phone-Jack Connector)



(2 pieces)

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COMPUTER DECISION INTERFACE

MULTI USER FAMILY

PC COM RS-422/485 CARD 1 PORT	$ 99.95
PC COM RS-422/485 CARD 2 PORT	$109.95
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PC COM 4 PORT RS-422 CARD	$149.95
PC COM 8 PORT RS-232 CARD (RJ11 CONNECTOR)	$239.95
PC COM 8 PORT RS-232 CARD (DB25 PIN)	$249.95
PC COM 8 PORT RS-232 CARD (W/EXPAN BOX)	$269.95
PC COM 8 PORT RS-422 CARD	$299.95
PC COM 16 PORT RS-232 CARD	$545.95
PC COM 8 PORT INTELLIGENT CARD	$645.95
PC COM SOFTWARE DRIVER	$ 59.95
PC COM 4/8 PORT DEVICE DR. FOR AT&T UNIX	$ 59.95
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RS-232 REPEATER	$ 59.95
RS-232/422 CONVERTER	$ 59.95

QUALITY DESIGN AND SUPPORT FOR A RANGE OF MULTI PORT SERIAL CARDS.

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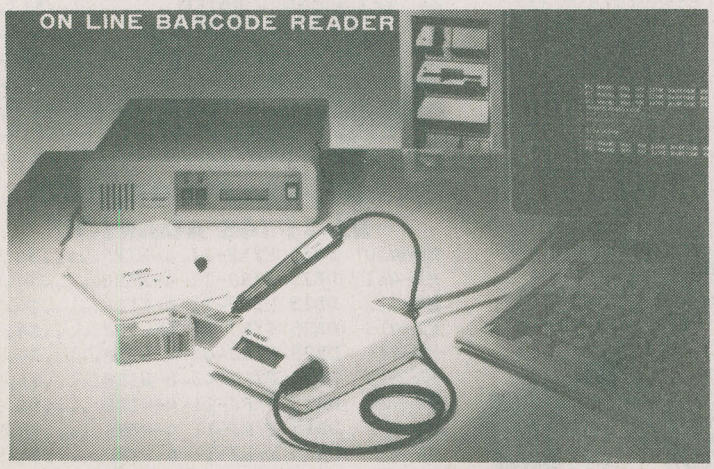
8W4200	232/422 READER WORKS WITH ANY COMPUTER SYSTEM EQUIPPED WITH AN INDUSTRY STANDARD RS-232 OR RS-422 INTERFACE	$395.95
8W4300	PORTABLE READER HAND-HELD SCANNING AND DECODING DEVICE WITH BUILT IN 48KB MEMORY FOR DATA STORAGE	$995.95
8W4350	PORTABLE PROGRAMMABLE READER HAND-HELD, C LANGUAGE PROGRAMMABLE READER WITH 64KB RAM	$1,295.95
8W4400	ONLINE READER FOR NETWORKING APPLICATIONS	$695.95



unitech

WEDGE READERS:		
100	KEYBOARD EMULATOR (IBM PC/XT/AT)	$375.95
200	TERMINAL WEDGE READER	$429.95
ON-LINE READERS:		
300	ON LINE READER (RS232 & 485)	$449.95
310	ON LINE READER (RS232 & 485) WITH L.C.D. DISPLAY	$549.95
SCANNERS:		
BP-20	ABS PLASTIC CASE HANDY DIGITAL SCANNER	$139.95
BP-31	STAINLESS STEEL CASE HANDY DIGITAL SCANNER	$169.95
BP-40	HIGH GRADE STAINLESS STEEL CASE, HANDY DIGITAL SCAN	$199.95
MT-211	MAGNETIC STRIP READER	$ 99.95
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TS-4000	CCD SCANNER: 3" READ WINDOW	$1,395.95
BA-20	LED NON-CONTACT SCANNER	$1,695.95
MSH-860	LASER NON-CONTACT SCAN	$2,250.95

Bar code readers

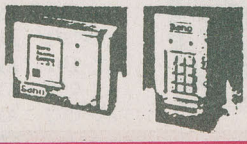
SAHO CORPORATION

SAHO ACCESS CONTROL SYSTEMS

SR-606/SR-706	SIMPLE TYPE
SR-606/SR-716	SECURITY TYPE
SR-620/SR-720	INTELLIGENT TYPE
SR-630/SR-730	ENHANCING TYPE
EN-1000	MAGNETIC CARD ENCODER
DM-970	TIME RECORDING TERMINAL
DC-660/DC-661	DATA CONCENTRATOR
VP-870	PC VOICE CARD
VP-880	VOICE DEVELOPMENT KIT

Saho ACCESS CONTROL SYSTEM (ACS)

SINGLAR



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15-PIN DB15 F/M OR M/M OR F/F..$ 5.50
25-PIN DB25 F/M OR M/M OR F/F..$ 5.50
37-PIN DB37 F/M OR M/M OR F/F..$ 7.50
36-PIN 36 CENT. F/M, M/M, F/F..$ 7.50
HD15-PIN DB15HD F/F OR M/M.....$ 7.50

ADAPTOR

DB25M/DB9F.....$ 6.50
DB25F/DB9M.....$ 6.50
DB25F/DB9F.....$ 6.50
36CENT.M/DB25M $ 6.95
36CENT.F/DB25F $ 6.95
36CENT.M/DB25F $ 6.95
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HD15M/DB9F.....$ 7.50
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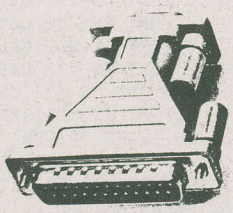
PS/2 6-PIN M / DB9 M..$ 6.50
TRIPORT ADAPTER DB25M/F--DB9M...$ 7.50
TRIPORT ADAPTER DB25M/F--DB9F...$ 7.50



RS-232 ADAPTER

REVERSE DB25M/F - M/M - F/F.....$ 6.50
NULL MODEM DB25M/F - M/M - F/F..$ 6.50
SURGE PROTECT DB25M/F.....$ 8.50
JUMPER BOX DB25M/F - M/M - F/F..$ 7.95
LOOPBACK TESTER DB25M/F.....$ 8.95
MINI TESTER DB25M/F.....$ 8.50
CHECK TESTER DB25M/F.....$ 9.95
WIRING BOX M/F - M/M - F/F.....$ 8.95
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CENTRONICS LINEBOOSTER.....$49.95
RS232 LINEBOOSTER.....$49.95
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RS232 --- RS422 TWO WAYS CONV...$69.95
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RS232 --- RS422 TWO WAYS
CURRENT LOOP CONVERT..$99.95

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RS232 ALL LINES BREAK OUT BOX...$79.95
RS232C QUICK TESTER.....$ 8.95
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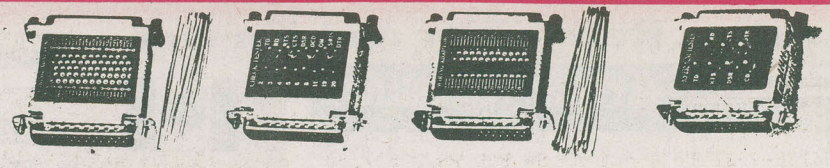

16 YEARS OF RELIABILITY,
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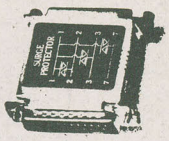
CABLE ASSEMBLIES



6' DB25M - CENT 36..$ 6.95
10' DB25M - CENT 36..$ 8.95
15' DB25M - CENT 36..$10.95
20' DB25M - CENT 36..$14.95
25' DB25M - CENT 36..$19.95
30' DB25M - CENT 36..$24.95
40' DB25M - CENT 36..$32.50
50' DB25M - CENT 36..$39.95
100' DB25M - CENT 36..$69.95
6' 36 CENT-36 CENT..$ 9.95
10' 36 CENT-36 CENT..$12.95

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6' DB25M/M...$ 7.95
10' DB25M/F...$ 9.95
10' DB25M/M...$ 9.95
15' DB25M/F...$12.95
15' DB25M/M...$13.95
20' DB25M/F...$19.95
20' DB25M/M...$22.50
25' DB25M/F...$35.95
25' DB25M/M...$27.50
30' DB25M/F...$32.95
30' DB25M/M...$34.95
50' DB25M/F...$59.95
50' DB25M/M...$64.50
100' DB25M/F...$99.95
100' DB25M/M...$99.95

MODEM CABLES

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RS232 MULTI-LINK ADAPTER
PROGRAMMABLE INTERFACE ADAPTER
PROGRAMMABLE INTERFACE MOUNT

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300' EXTENSION KIT.....$69.95
1200' EXTENSION KIT.....$99.95
KITS INCLUDE: RECEIVER AND TRANSMITTER & 25' CABLE (RJ11)

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6' PS/2 KEYBOARD EXTENSION.....$ 8.95
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POWER CORD CONVERTER.....$ 7.50
POWER CABLE.....$ 5.50
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MB-411 DB25 F/RJ-11 4-WIRE.....$4.95
MB-412 DB25 M/RJ-11 6-WIRE.....$4.95
MB-413 DB25 F/RJ-11 6-WIRE.....$4.95
MB-414 DB25 M/RJ-45 8-WIRE.....$4.95
MB-415 DB25 F/RJ-45 8-WIRE.....$4.95
MB-420 DB15 M/RJ-11 4-WIRE.....$4.95
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MB-423 DB15 F/RJ-11 6-WIRE.....$4.95
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MB-425 DB15 F/RJ-45 8-WIRE.....$4.95
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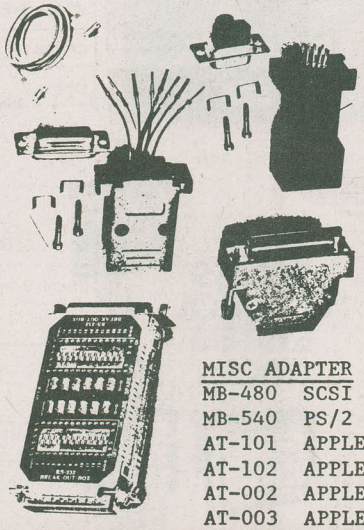
MB-433 DB9 F/RJ-11 6-WIRE.....$4.95
MB-434 DB9 M/RJ-45 8-WIRE.....$4.95
MB-435 DB9 F/RJ-45 8-WIRE.....$4.95



MISC ADAPTER

MB-480 SCSI TERMINATOR C50 M/F MOLDED.....$19.95
MB-540 PS/2 DATA MIGR. ADP DB25M/C36F MOLDED..$19.95
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AT-003 APPLETALK PHONENET FOR MAC 128K, 512K..$17.50

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DS0615H-2	KEYBD & MON AB SW FOR PS/2	$27.50
DS0615H-4	KEYBD/MON ABCD SW FOR PS/2	$39.50
DS252	25 PIN AB SWITCH.....	$19.95
DS253	25 PIN ABC SWITCH.....	$24.50
DS254	25 PIN ABCD SWITCH.....	$29.95
DS255	25 PIN ABCDE SWITCH.....	$42.50
DS256	25 PIN ABCDEF SWITCH.....	$49.95
DS25X	2 IN, 2 OUT CROSSOVER.....	$34.50
DS25W	3 IN, 2 OUT CROSSOVER.....	$39.95
DS362	36 PIN AB SWITCH.....	$24.95
DS363	36 PIN ABC SWITCH.....	$29.95
DS364	36 PIN ABCD SWITCH.....	$34.95
DS365	36 PIN ABCDE SWITCH.....	$44.50
DS366	36 PIN ABCDEF SWITCH.....	$59.95
DS36X	2 IN, 2 OUT CROSSOVER.....	$29.95
DS36W	3 IN, 2 OUT CROSSOVER.....	$42.50
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DS093	9 PIN ABC SWITCH.....	$24.95
DS094	9 PIN ABCD SWITCH.....	$29.95
DS09X	2 IN, 2 OUT CROSSOVER.....	$32.50
DS082	8 PIN AB SWITCH.(MINI DIN)..	$24.50
DS083	8 PIN ABC SWITCH.....	$27.50
DS084	8 PIN ABCD SWITCH.....	$32.50
DS08X	2 IN, 2 OUT CROSSOVER.....	$34.50
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DSRJ11/4	RJ11 6P/6C ABCD SWITCH.....	$32.50
DSRJ11/X	2 IN, 2 OUT CROSSOVER.....	$34.50
DSRJ45/2	RJ45 8P/8C AB SWITCH.....	$24.50
DSRJ45/3	RJ45 8P/8C ABC SWITCH.....	$27.50
DSRJ45/4	RJ45 8P/8C ABCD SWITCH.....	$32.50
DSRJ45/X	2 IN, 2 OUT CROSSOVER.....	$34.50
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DSBNC/4	BNC ABCD SWITCH.....	$37.50
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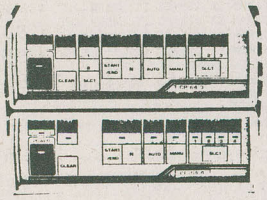
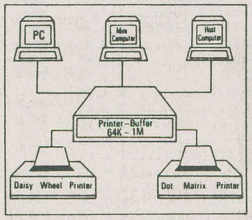
DSTWX/2	TWINAX AB SWITCH.....	$29.95
DS372	37 PIN AB SWITCH.....	$34.95
DS2BNC/2	DUAL PORT BNC AB SWITCH.....	$27.50
DS62H/2	HDD62 PIN AB SWITCH.....	$69.95





AUTO DATA SWITCH BOX

DSA101	AUTO DATA SW PARALLEL 2 PORT..	$ 59.95
DSA102	AUTO DATA SW PARALLEL 4 PORT..	$109.95
DSA103	AUTO DATA SW SERIAL 4 PORT....	$109.95
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DSA109	PP41A PARALLEL 4 IN 1 OUT.....	$139.95
DSA110	CP64-3 CENT 3 IN 2 OUT W/64K..	$225.95
DSA111	CP64-1 CENT 1 IN 2 OUT W/64K..	$179.95
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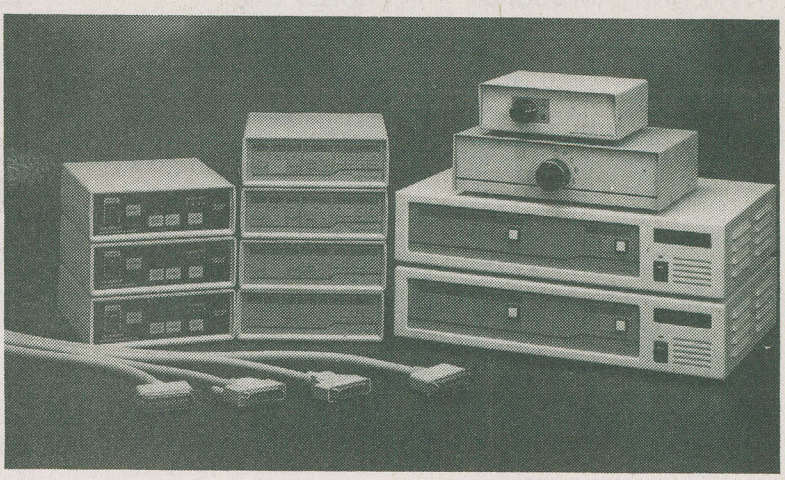
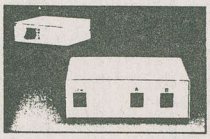
DSA113	KC7017 CENT 2 IN 3 OUT W/64K..	$289.95

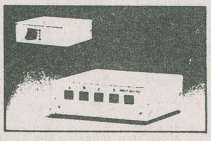
COSMOS COMPUTER CORPORATION

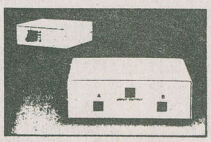


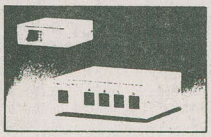
PC ⟶ Printer
1 ⟶ 1
1 ⟶ 2
2 ⟶ 1
3 ⟶ 2
4 ⟶ 1
7 ⟶ 1
8 ⟶ 1

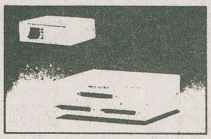
With Buffer or without Buffer
Parallel • Series mode

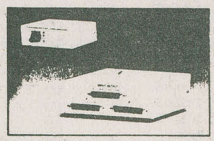












COSMOS PRINTER BUFFER

Functions / Models	Channels	Adaptor Power DC 9V	Memory	Access Memory	Interface parallel IN parallel OUT
CP-64	1IN-1OUT	500mA	64K	62K	36PIN
CP-64-1	1IN-2OUT	500mA	64K	62K	36PIN
CP-64-2	2IN-1OUT	500mA	64K	62K	36PIN
CP-64-3	3IN-2OUT	800mA	64K	62K	25PIN (F)
CP-64-4	4IN-1OUT	800mA	64K	62K	25PIN (F)
CP-256	1IN-1OUT	800mA	256K	252K	36PIN
CP-256-1	1IN-2OUT	800mA	256K	252K	36PIN
CP-256-2	2IN-1OUT	800mA	256K	252K	36PIN
CP-256-3	3IN-2OUT	800mA	256K	252K	25PIN (F)
CP-256-4	4IN-1OUT	800mA	256K	252K	25PIN (F)
CP-512	1IN-1OUT	800mA	512K	508K	36 PIN
CP-512-1	1IN-2OUT	800mA	512K	508K	36PIN
CP-512-2	2IN-1OUT	800mA	512K	508K	36PIN
CP-512-3	3IN-2OUT	800mA	512K	508K	25PIN (F)
CP-512-4	4IN-1OUT	800mA	512K	508K	25PIN (F)
CP-1	1IN-1OUT	800mA	1M	1020K	36PIN
CP-1-1	1IN-2OUT	800mA	1M	1020K	36PIN
CP-1-2	2IN-1OUT	800mA	1M	1020K	36PIN
CP-1-3	3IN-2OUT	800mA	1M	1020K	25PIN (F)
CP-1-4	4IN-1OUT	800mA	1M	1020K	25PIN (F)

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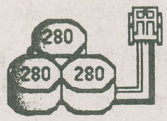

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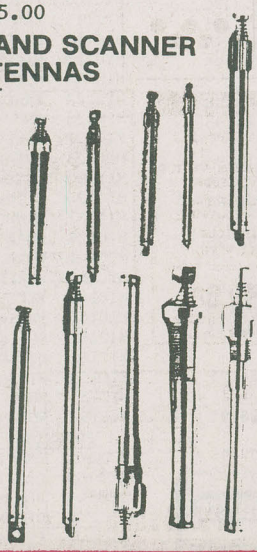

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PART NO:3/280 STK 3.6V 280mAh	PART NO:3/280 CL 3.6V 280mAh	PART NO:3/280 3.6V 280mAh	PART NO:2X1/ 280 3.6V 280mAh
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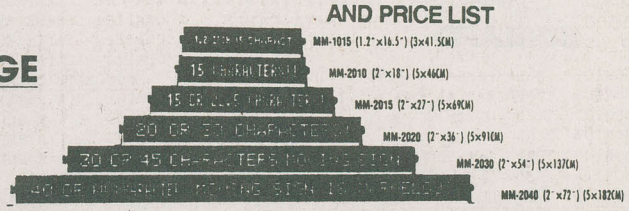

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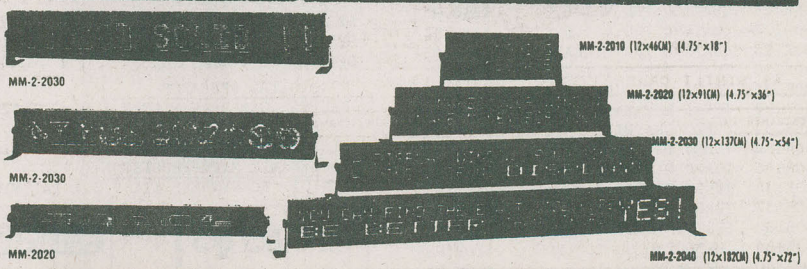

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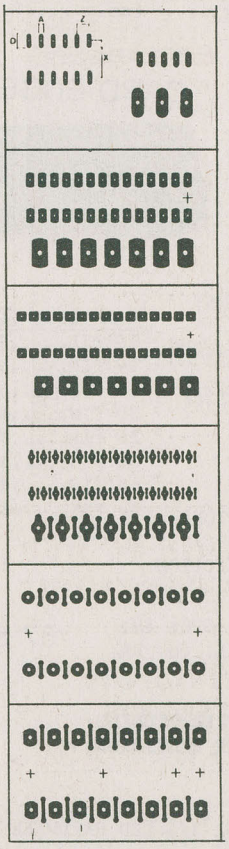
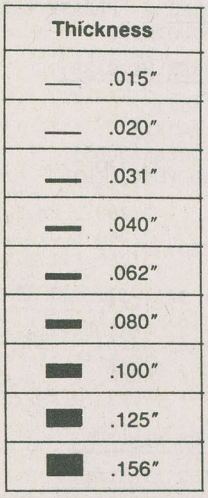
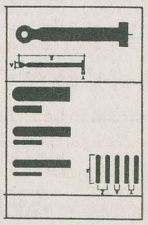
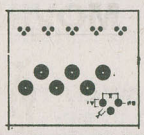
CERESIST

DRY TRANSFER GRAPHICS









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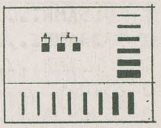
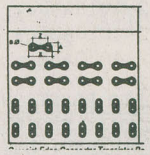
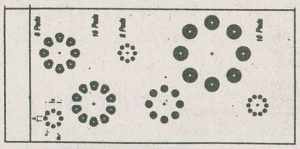
CERESIST 30 - 40 - 60° ELBO



CERESIST DOUBLE PADS





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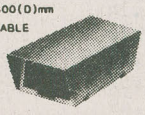
DIMENSIONS: 125(W)x100(H)x400(D)mm
CONSTRUCTION: ACIER INOXYDABLE STAINLESS STEEL
POIDS/WEIGHT: 1.3 Kgs.



PIH-5005 $99.00

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DIMENSIONS: 185(W)x144(H)x540(D)mm
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POIDS/WEIGHT: 6.4 Kgs.
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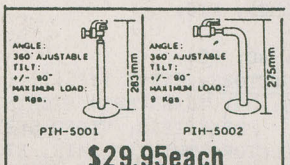

$29.95each

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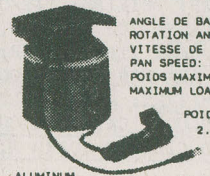

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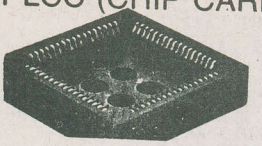
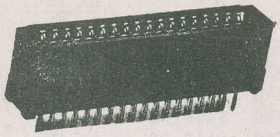
PLCC (CHIP CARRIER)



PLCC (CHIP CARRIER)
44 PIN.....$1.49
68 PIN.....$2.49
84 PIN.....$3.45

SLOT

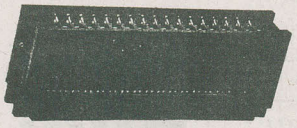


SLOT
36 PIN.....$1.49
62 PIN.....$1.95
98 PIN.....$2.75

MINI JUMPER

MINI JUMPER
4.5mm.....$ .25
6mm.....$ .25

CARD EDGE



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10 PIN.....$1.09
14 PIN.....$1.19
16 PIN.....$1.45
20 PIN.....$1.45
26 PIN.....$1.75
34 PIN.....$1.75
40 PIN.....$1.95
50 PIN.....$2.45

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FLAT TYPE CABLE
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DB9S.....$1.95
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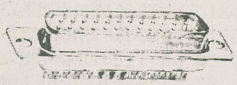
DB15S.....$1.99
DB25P.....$2.25
DB25S.....$2.49
DB37P.....$3.25
DB37S.....$3.89

SOLDER TYPE



SOLDER TYPE
DB9P.....$ .90
DB9S.....$ .99
DB15P.....$1.09
DB15S.....$1.29
DB19P.....$1.49
DB19S.....$1.59
DB23P.....$1.69
DB23S.....$1.89
DB25P.....$1.09
DB25S.....$1.29
DB37P.....$1.89
DB37S.....$1.99
DB50P.....$2.49
DB50S.....$2.95

HOOD

HOODS
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23 PIN....$ .95
25 PIN....$ .95
37 PIN....$1.29
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25 PIN....$1.95
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9 PIN....$ .95
15 PIN....$1.05
23 PIN....$1.29
25 PIN....$1.09
37 PIN....$1.49

P.C.B. RIGHT ANGLE TYPE

P.C.B. RIGHT ANGLE TYPE
DB9P.....$1.09
DB9S.....$1.29
DB15P.....$1.35
DB15S.....$1.49
DB25P.....$1.49
DB25S.....$1.69
DB37P.....$1.89
DB37S.....$1.95

57 SERIES CONNECTORS SOLDER TYPE

57 SERIES CONNECTORS
SOLDER TYPE
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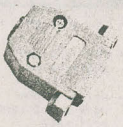

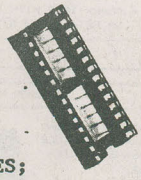

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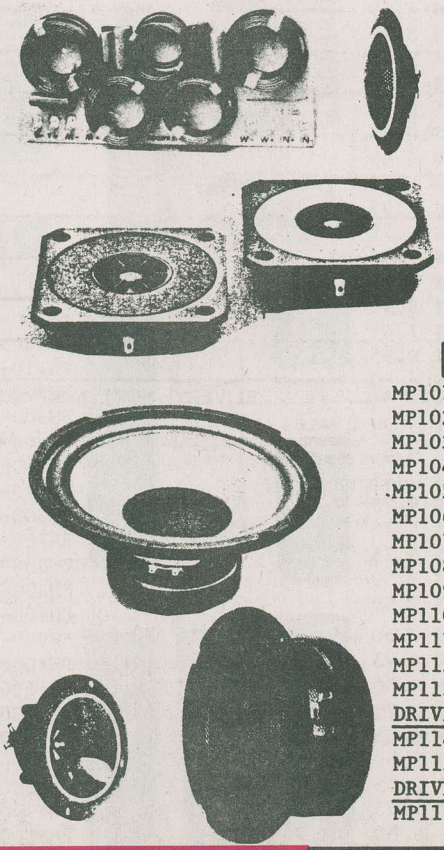

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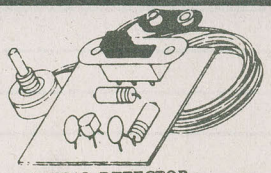
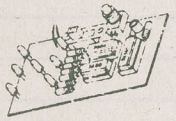


METAL DETECTOR



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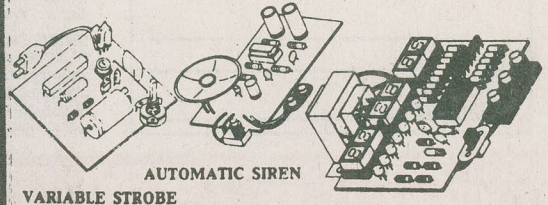

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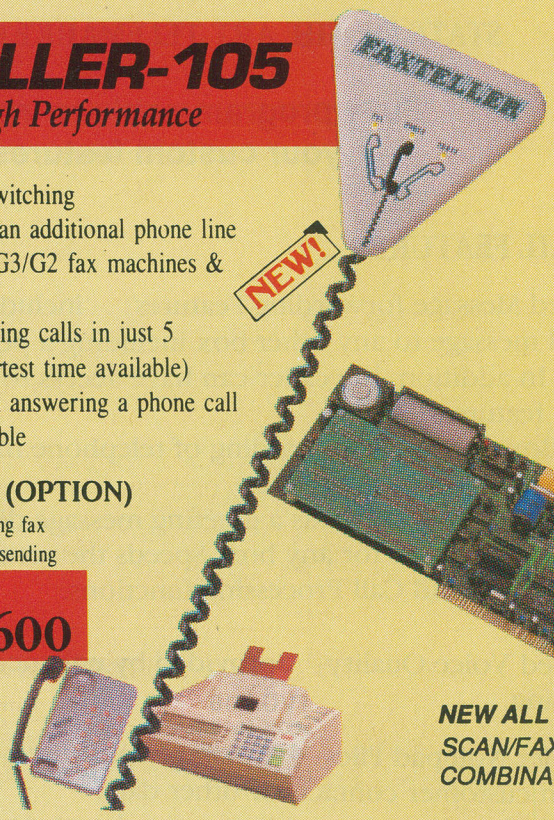

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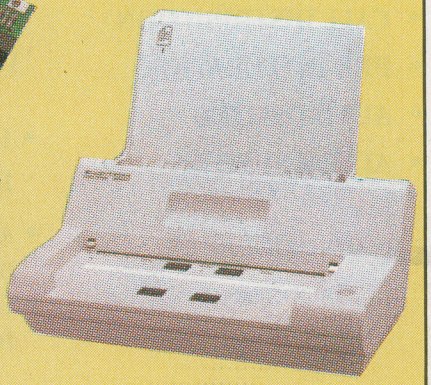

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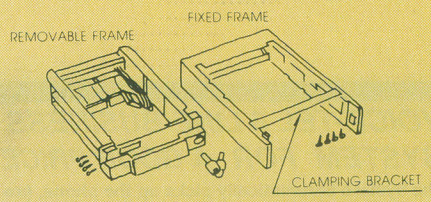

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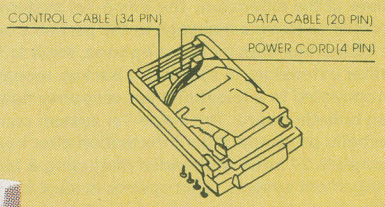

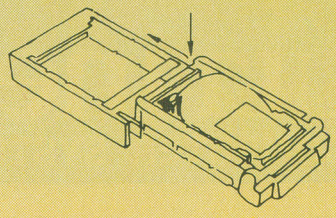

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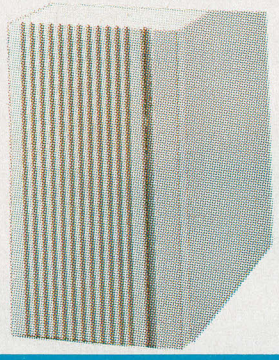

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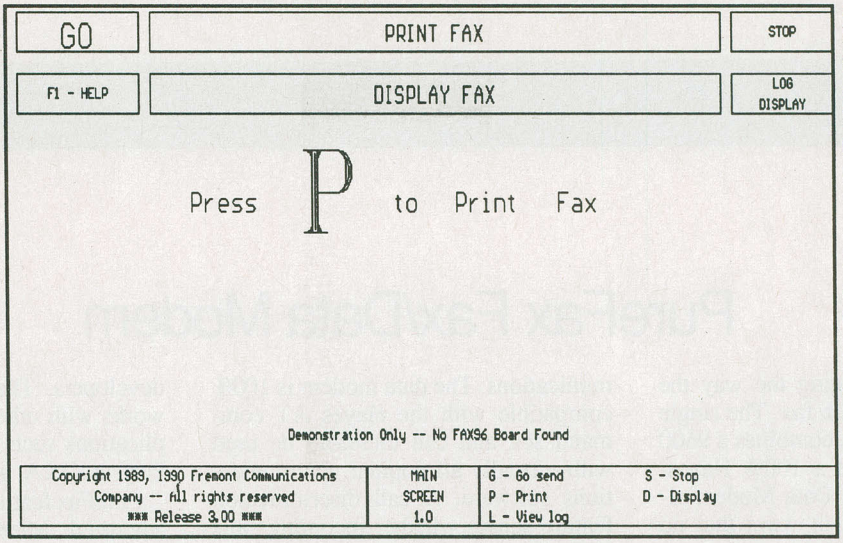
Fremont Faxography™

Fremont Communications Company, the manufacturer whose Fax96 was recently named *PC* Magazine's Editors' Choice in the PC fax board category, is shipping a new kind of software which lets its Fax96 customers improve the output quality of their fax messages. Named Frecom WYPIWYF-LQ™ (What You Print Is What You Fax) software, it translates the output of popular personal computer applications software into fax images that can be sent to any Group III fax machine. The result is very high quality output, noticeably superior to messages that have been scanned by a fax machine.



"What we are doing with this new software," said Paul Masters, President of Fremont, "is creating an entirely new way of faxing: Faxography. With our Fax96 board inside the PC and this software translating application software output — text and graphics — into Letter Quality format, we cut out two time-consuming and image-degrading steps (printing and scanning) in the process of sending a fully formatted fax."

Fremont's first WYPIWYF program provides full Letter Quality (LQ) dot matrix printer and 24-pin graphics emulation. Any PC application program (word processing, spreadsheet, database programs, desktop publishing applications, for instance) that supports Epson, IBM or similar printers can generate letter quality fax messages, including graphics, with Fremont's WYPIWYF-LQ software.

The user sets up his or her application software to use Epson printer formatting controls, but instead of printing a hard copy, the user selects the "print-to-disk" or "print-to-file" command. Fremont's WYPIWYF-LQ software then converts that file into fax format. When transmitted to another fax machine, it will be printed in the specified resolution. Both Group III resolutions — high (200x200 dpi) and regular (200x100dpi) — are included. Fax versions of all LQ fonts (regular, bold, italic and bold italic versions of two type styles in eight sizes plus five styles of proportional spaced type for each style) are included with the software.

"There are really 648 fonts included with WYPIWYF-LQ," said Richard Bennett, Fremont's Vice President of Product Development, "when you include outline, shadow, and the double-wide and double-high versions."

Faxography

"95% of the crispness of faxed documents is lost by the relatively crude scanning and paper handling devices used in standalone fax machines," said Paul Masters, President of Fremont Communications Company. "Faxography, using our Fax96 board and this new WYPIWYF software, lets our customers fax directly from their computer without scanning. Their faxes gain a new degree of clarity and professionalism. Their correspondents immediately recognize the improved look of documents that have **bold face**, underlining *italics* and important font changes they are accustomed to seeing with LQ and other dot matrix printers."

"When we introduced the FAX96," Masters continued, "we solved the price and ease-of-use issues for PC fax cards. As a result, analysts tell us we are on a track that will at least double the size of the PC fax board business this year. Now, with Faxography, our Fax96 customers can fax virtually anything they can print, whether they use a Letter Quality printer or not." ❐

Intel PCEO Delivers SatisFAXtion

Intel Corporation's Personal Computer Enhancement Operation (PCEO) announced the first multi-function PC fax board with one-step, *What You Print Is What You Fax (WYPIWYF™)* interface.

SatisFAXtion™, Intel's second-generation PC fax board, combines a 9600bps fax modem, 2400bps MNP (Microcom Networking Protocol) 5 data modem and grayscale scanner port in a single slot.

"Customers told us they want to fax from within their software applications without exiting to run a special program," said Richard Gough, manager of Intel PCEO's communications business unit. "SatisFAXtion combines substantially improved ease of use with extraordinary product value. SatisFAXtion allows direct faxing from any application that can print, even from the DOS prompt.

"There is no easier way to send a fax than with SatisFAXtion. It's as close as you can get to universal E-mail."

In contrast to boards that require users to exit their software application and load their fax application before sending, SatisFAXtion's WYPIWYF

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pop-up menu lets users fax as easily as printing, without leaving their primary application. To send a fax, the user selects the "fax" printer, and the WYPIWYF pop-up menu lets users fax as easily as printing, without leaving their primary application.

After specifying the recipient's name and phone number and the time to send the fax, the user gives the application's print command, and SatisFAXtion transmits the fax. Unlike many boards that lock up the computer or drain its resources while faxing, SatisFAXtion uses a 16MHz 80186 processor to fax in the background, without interrupting the user's work flow or slowing system performance.

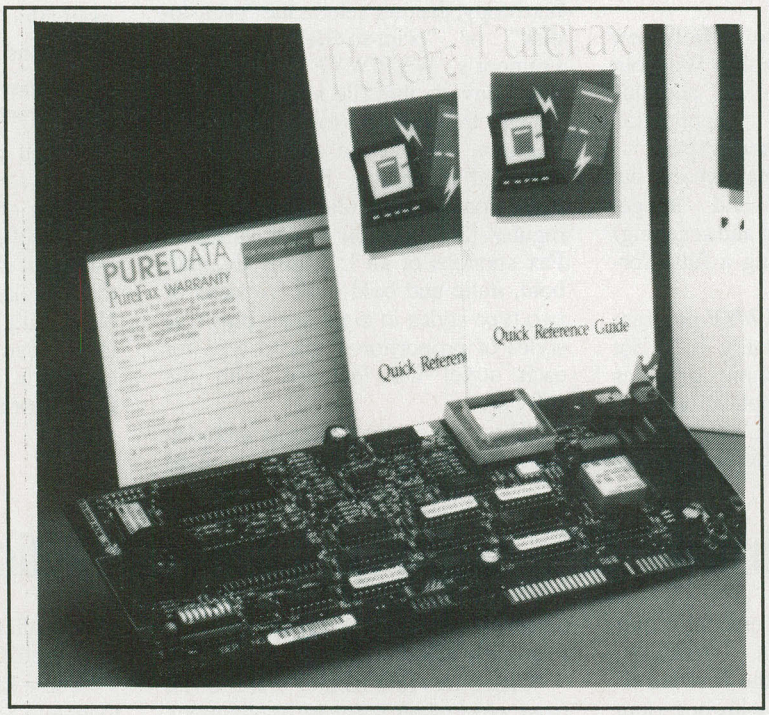
SatisFAXtion users can fax from any application capable of formatting a file for an Epson FX85 printer. Epson fonts and formats are fully preserved, and standard Windows screen fonts are preserved in Windows environments. SatisFAXtion supports Intel/DCA Communicating Applications Specific (CAS), enabling developers to incorporate custom fax capabilities into their applications. The board is hardware-ready for integration into OS/2 environments. ❐

PureFax Fax/Data Modem

PureFax is changing the way the world works with fax. The single slot card, which combines a 9600 bps Fax Modem and a 100% Hayes-compatible 2400 bps Data Modem allows you to use fax in ways that no dedicated fax machine can match.

With PureFax installed in a PC, you have a versatile and comprehensive set of communications tools for transmitting text, graphics and data, right from your workstation. Now you can send and receive fax messages from every workstation on the network, eliminating lineups at the fax machine, and putting an end to poor quality output on expensive thermal paper.

Two PureFax models are available — one for network and one for standalone use. A network software upgrade kit is also available, providing users of the standalone version with a simple network upgrade path.



PureFax adheres to all existing fax modem guidelines, and has been carefully designed to maintain compatibility with today's evolving standards — in both data and fax communications. The data modem is 100% compatible with the Hayes AT command set, and can therefore be used with virtually all popular communications software. A call discrimination feature senses whether incoming calls are for the fax or data modem, and routes them to the appropriate device.

PureFax is compatible with the Communicating Applications Specification (CAS which defines a standard programming interface for software developers. That means that PureFax works with other CAS-compatible applications such as Lotus 1-2-3, WordPerfect, Q&A, and cc:Mail.

PureFax features *Fax Manager* — an advanced Microsoft Windows-based application, that provides facilities for fax transmission, reception, graphic file conversion, and editing. A run-time version of microsoft Windows is included with the standalone version. The network version is supplied with *The Network Fax Supervisor* — providing a security-controlled network operation. The network Fax Supervisor acts as the network administrator, managing and controlling fax transmission, reception and distribution on the network. PureFax can be installed in any IBM PC/XT, AT, PS/2 Model 25, 30 30/286, or 100% IBM compatible computer with at least 640K of memory, a fixed disk drive, and a graphics display adapter and monitor (a mouse is optional). PureFax can also be used with many laptops. ❐

Lanier

Lanier Canada, Inc. introduced the newest series of high-volume sending and receiving machines compatible with CCITT Groups 3 and 2. The company also introduced a 1MB memory accessory for fax machines.

According to Lanier, the LanierFax 2275, the most powerful of the three new 2200 machines, is an ideal hub unit for Fax networking, able to "batch transmit" documents which are stored and programmed to disperse automatically to remote units in a single transmission.

The 2275 also includes a 50 page automatic document feeder, 60 one-touch speed dialing numbers, 252 total phone numbers stored and 48-number group dialing capability. Other features include a 50-number delay transmit capability, tel/fax auto switching and a confidential receive function.

The LanierFax 2230 and 2260 possess cost- and time-saving capabilities that can make an impact on office productivity. The LanierFax 2230's features include, battery-powered back-up to protect stored documents, no paper receive to prevent lost incoming messages, delay memory transmission to save long-distance costs, the ability to initiate a relay broadcast to up to 99 units, closed user group and confidential transmission features, voice response to calls other than from facsimile units, CCITT Error Correction Mode–eliminating communications errors and speed dialing of up to 100 stored phone numbers.

The LanierFax 2260 has these features, but adds an RS232 port for computer interfacing, and is equipped with a 512K (30 page) memory.

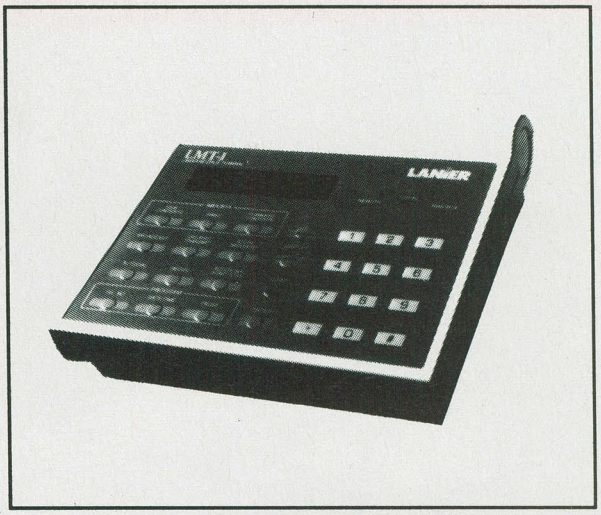
The LanierFax 2230 and 2260's memory capabilities enable documents to be scanned, stored and sent to a combination of receiving units at the touch of a button. The units may be programmed to send transmissions during the times of day when long-distance rates are lowest. A battery-powered back-up system protects stored documents during power interruptions. For added convenience, the Lanier models 2230 and 2260 feature a built-in telephone handset.

Each Lanier unit's memory also accepts and stores incoming messages should the units run out of paper. A visual alarm alerts the user when there's a stored transmission waiting to be printed. The systems store the transmissions until facsimile paper is replaced.

The LanierFax 2230 and 2260 have two features that protect confidentiality. A closed user group feature enables the user to specify facsimile units with which the LanierFax unit is authorized to communicate, in both send and receive modes. This eliminates wrong number receptions, prohibits unauthorized use of the machine, and prevents incoming "junk fax."

Second, the confidential transmission feature enables the user to send messages to "mailboxes" within other compatible LanierFax units. Receiving units will print messages only after a correct password is entered.

Lanier Canada also introduced the Lanier Message Terminal (LMT-1), an accessory which enables any ordinary facsimile unit to become a communications centre.



The LMT-1 adds one megabyte of memory, allowing the user to "upgrade" regardless of the manufacturer or model, or even to add memory to a non-memory machine. Features include confidential mailboxes with remote retrieval, broadcasting to 100 locations, and delayed sending of messages after hours to reduce long-distance phone bills.

The mailbox reception actually bypasses the host unit. When someone sends a confidential message, the LMT-1 stores it in the user's mailbox, not printing the message until an assigned security code is entered. The LMT-1 also allows the user to forward confidential messages to other Fax machines or retrieve their mailbox contents from a remote Fax system. The feature also allows the user to screen callers by limiting access, to eliminate "junk mail" from unauthorized units.

Dan McDermid, marketing manager in Lanier's business development, said, "The LMT-1 gives the user the ability to make any facsimile unit more powerful, more secure, and more cost-effective." ❐

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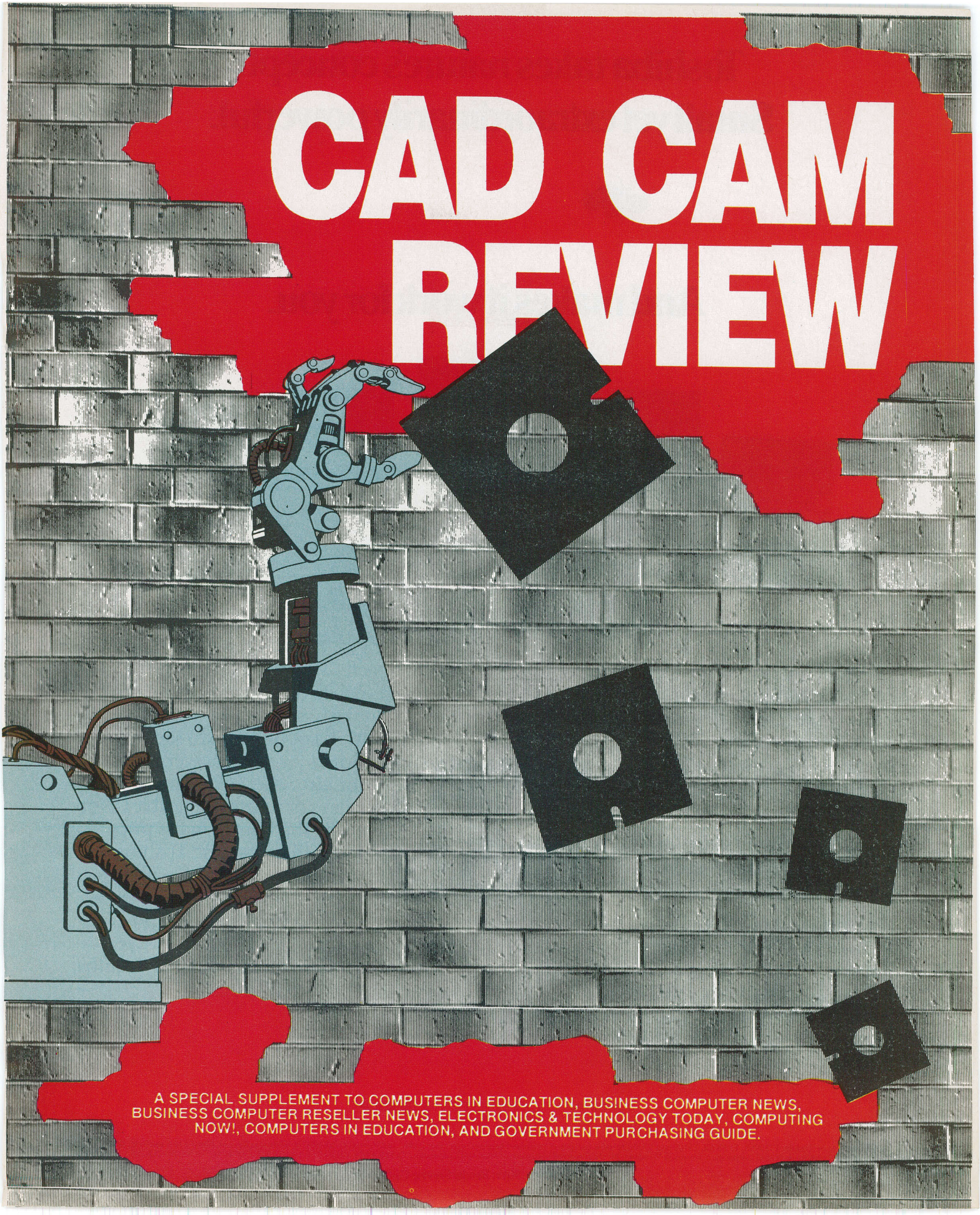

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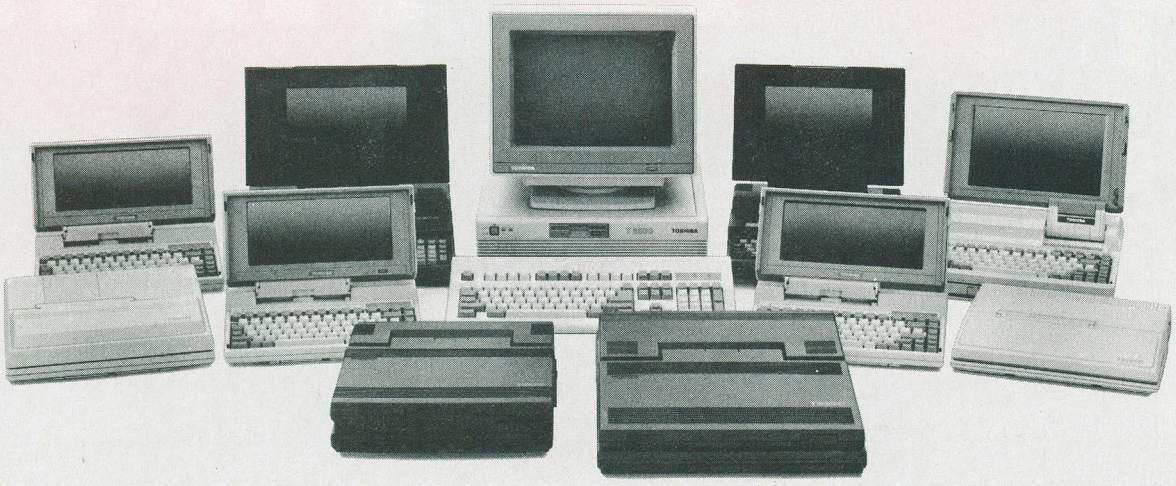

Without question, Toshiba's "First Family" of portable computers demonstrate the perfect combination of power, performance, quality and portability. That's why the vast majority of all portable PC's sold in Canada, proudly carry the Toshiba name.

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Circle No. 90 on Reader Service Card

Secrets of Painless 3D

Custom menu macros can help you work efficiently in AutoCAD's 3D.

Bill Markwick

AutoCAD has featured 3D for years now, although it wasn't until Release 10 that it became a real alternative to 2D, as opposed to a sales tool for producing impressive demos. The advantages were obvious: a single master drawing could be rotated in 3D space to provide plan views, elevations, and any view in between. Perspective views could also be generated, again from any viewpoint. If the drawing was done to exact scale, the fit of parts could be easily checkedt.

The disadvantages were also obvious. The newcomer to 3D became lost in a never-never land of coordinate systems, unfamiliar viewpoints, massive amounts of typing, and CAD entities that seemed to have minds of their own.

If you can see the advantages of 3D but are baffled by the adaptation, read on. There's hope.

3D Tools

With Release 10, Autodesk provided a way to cope with the difficulties of maneuvering in 3D space: the User Coordinate System, or UCS. With this system, the operator could choose the origin point (*ie*, X, Y, and Z become 0,0,0 at whatever point you want). If you wanted to work on an angled skylight on a roof, for instance, the UCS could be attached to the skylight by picking new X, Y, and Z points from the skylight itself (for instance, by picking the corners of the skylight as the new X, Y, and Z). Now the operator would be drawing as if the glass of the skylight were the new plan view. To instantly get back on familiar ground, the operator chooses the World Coordinate System. This is pretty much equivalent to the standard plan view of a building or other object.

Fig. 1. shows the application of the UCS to an angled skylight sitting on an elevated surface. Now all entities (including text) will be drawn on the angled surface of the skylight. Selecting a plan view will make the skylight glass parallel to the monitor screen.

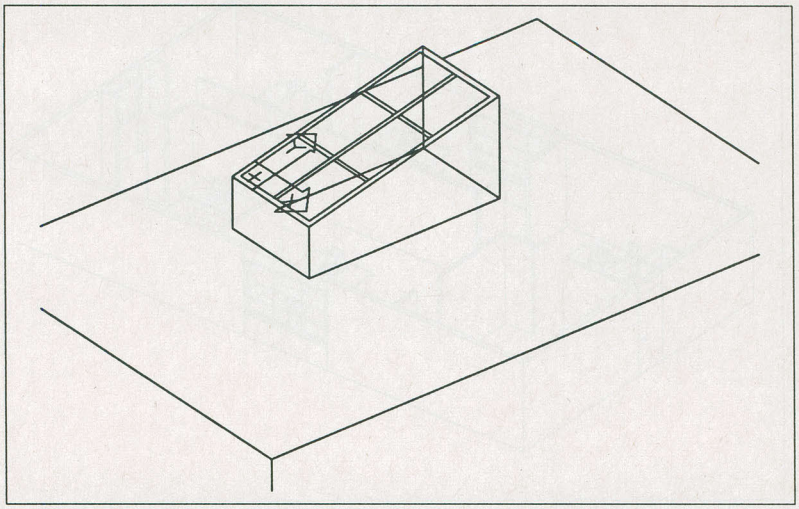


Fig. 1. The angled surface is easily worked on by attaching the User Coordinate System icon to it. A simplified menu macro for doing this is explained in the text.

This new system is vastly better than the ELEV and THICKNESS commands of previous releases, but the 3D newcomer may not think so, especially when dealing with the oddities of actually getting the UCS icon exactly where you want it.

Another important tool for getting around is the VPOINT command. Viewpoints are critical to eliminating those irritating optical illusions (lines that look perfect in one view are heading off into space in another). However, the VPOINT icon is a bit strange, to say the least, and it needs some help before it becomes really convenient to use.

Once the basic frame of the drawing is done, the operator needs to make at least some of the objects opaque in order to produce a realistic rendering for plotting out. This is where the 3DFACE command and a few of the specialized 3D surfacing commands come into their own. These also need some massaging before you can use them quickly.

The Custom Menu

AutoCAD lets you write your choice of commands into the menu file, and you can even make them into macros. This feature is the one that transforms 3D from a confusing tangle to a valid drawing tool.

There are two approaches to writing a custom menu. First and easiest is to modify the existing menu from Autodesk. Second is to write your own from the ground up. We'll use the first method; if you find that these methods simplify your CAD work, you'll probably want to try the second.

You'll need a word processor that can make ASCII files, such as WordStar in the N mode or WordPerfect in the text/in/out mode. Now find the

file ACAD.MNU, which lives in directory called SOURCE on one of your main AutoCAD disks. This is a large ASCII file containing the various AutoCAD menu commands. When you load AutoCAD, it looks for this MNU file and checks to see if it's been modified. If so, it then compiles it into the binary file ACAD.MNX. Every time you do any editing, AutoCAD automatically updates the files when you load up.

If you can't locate the file ACAD.MNU, you can make it from the file ACAD.MND, which is an annotated version used as input to the menu compiler MC.EXE (which comes with AutoCAD). If you have ACAD.MND and MC.EXE in your AutoCAD main directory, type MC ACAD and the ASCII file ACAD.MNU will be produced.

Load ACAD.MNU into your ASCII word processor and have a look around. The square brackets enclose the name that will appear in the pulldown ("POP") menus or the right-hand screen sidebar. The commands to the right of the square brackets are what is actually fed to the AutoCAD command line. For instance, [LIST]^c^cLIST;AUTO will cancel any command in progress (in case you've clicked on the wrong one) and start the LIST command. The semicolon is the menu symbol for a Return, and AUTO puts the LIST command into the automatic-pick mode (drag to the right for a window, to the left for a crossing window). Note that the semicolon, the space, and the Return key all have the same function. Other commands and symbols will be explained as we go along.

Now we have some real power. We can automate all those cumbersome 3D commands and have you zipping around in 3D space in no time. Well, almost no time.

A Menu Tryout

Let's start by simplifying the VPOINT command. This will let you spin the drawing around to your heart's content just by clicking on the menu.

First, decide whether you want the new commands to appear in a pulldown or a screen menu. There's lots of room in the ACAD.MNU pulldowns (Hercules monitors can display 20 menu lines, VGA about 26), and there's only so much room in the screen sidebar, so you might want to limit the sidebar to your favorite commands and put everything else in pulldowns. The AutoCAD pulldown Display shows up in the MNU file as POP4 at line 95, and there's space in it for extra lines, as well as Settings, POP5, and Options, POP6. The sidebar menu is called SCREEN (you'll find that these main headings begin with asterisks).

Here are some macros that let you view the drawing from an angle above, with left, right and rear viewpoints. Add these lines to your choice of pulldown (or sidebar, but remember that the sidebar can only display eight characters — the pulldowns automatically expand in width).

```
[UPPER LEFT]^CVPOINT;-2,-2.5,2;
[ABOVE CENT.]^CVPOINT;-0.0557,
   -0.2400,0.9692
[UPPER RIGHT]^CVPOINT;2,-2.5,2;
[RIGHT REAR]^CVPOINT;0.35,0.35,0.35
[LEFT REAR]^CVPOINT;-.35,0.35,0.35
PLAN
```

Note that the command PLAN appears on its own; it doesn't need anything else because it's a direct AutoCAD command. Now start AutoCAD and your menu should be recompiled. Pull down the modified menu and you should see your commands. If you have a 3D drawing loaded, try it out. With one mouse click you can spin the drawing around to suit you. You can also put in any other viewpoints you want. First, use VPOINT or DVIEW to rotate the drawing to the preferred angle. Then type VPOINT to see what the coordinates are. Type them into the menu following the syntax shown above.

Load AutoCAD. The command line should say "Compiling ACAD.MNX". Try out your new commands.

More Views

The basic viewpoints above are fine, but you'll probably spend a lot of time working on one particular section of the drawing. It's nice to be able to instantly get this viewpoint back when you want it, so here's a screen macro that lets you save and recall views. Add the following line to the SCREEN section:

```
[VIEW]^c$S=VIEW
```

Now add these lines just *after* the SCREEN menu, (that is, following the command UTILITY):

```
**VIEW
[List]^CVIEW ?
[Del]^CVIEW D $S=SCREEN
[*CANCEL*]^C^C$S=SCREEN
[Restore]^CVIEW R $S=SCREEN
[Save]^CVIEW S $S=SCREEN
[Main]^CVIEW R MAIN $S=SCREEN
```

Now when you load AutoCAD, the word VIEW should appear in the

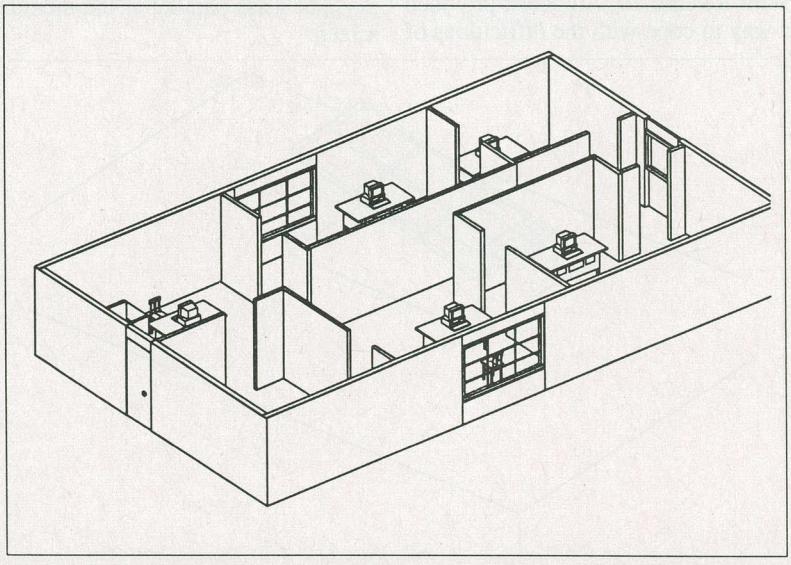


Fig. 2. A simple architectural drawing. The 3D features were greatly simplified by the UCS, Vppoint and 3dface techniques explained in the text.

sidebar. Click on it and the sidebar should change to the little VIEW menu shown above. Try out one of the items (or Cancel) and the main sidebar should reappear. And the command MAIN? It's used to return you to your current favorite view, which you should have previously named MAIN.

Note that if you use a series of favorite views, you could add them to the above submenu (as View1, View2, or whatever you prefer).

The UCS Menu

The UCS is a very powerful command, and as such requires a lot of typing. Here's a new pulldown for ACAD.MNU that does all sorts of automated tricks for you. Since AutoCAD allows up to ten pulldowns and uses only eight, we'll make this one number nine. Add these lines after POP8 (the Help menu).

```
***POP9
[-UCS-]
[DIALOG BOX]^CDDUCS
[ICON at Origin]^CUCSICON;OR
[ICON in Corner]^CUCSICON;NO
[Icon]^CUCSICON
[Icon
Test]^CUCSICON;OR;DELAY;750;UCSICON;
   NO
[—]
[Plan, current]^CPLAN;;
[Plan, world]^CPLAN W
[Plan, ucs]^CPLAN U
[—]
[New ORIGIN]^CUCS;O;$S=SMLTOOLS
[ORIGIN,int]^CUCS;O;INT;\UCSICON;OR;
   DELAY;750;UCSICON;NO
[UCS]^CUCS
[RESTORE UCS]^CUCS;R
[SAVE UCS]^CUCS;S
[WORLD UCS]^CUCS;W
[Auto UCS
I-N-N]^CUCS;3;INT;\NEA;\NEA;
   \UCSICON;OR;DELAY;750;UCSICON;NO
[Auto UCS
I-I-I]^CUCS;3;INT;\INT;\INT;
   \UCSICON;OR;DELAY;750;UCSICON;NO
[List all UCSs]^CUCS;?
[List Current UCS]^P(PRINC "Current
   UCS name is ")(GETVAR "UCSNAME")
```

The Icon commands at the beginning let you move the UCS icon around to confirm that the origin is really where you want it. Icon Test will make the icon jump to the origin for about one second and then jump back to the corner again. It's always a good idea to make sure that any UCS change worked the way you wanted it to, or you'll be wasting a lot of time and effort.

The left backslash in the above menu means "pause for user input", which can be either typing or a mouse click.

The Origin commands replace the ELEV command used in older versions of AutoCAD. Just pop the origin onto a convenient spot, generally by using the OSNAP tools. I've included the Origin-Int command because intersections are the most often used Osnap method.

The Auto UCS may well become a favorite macro. The I-N-N version uses an Osnap Intersection and two Near points for setting the UCS, and the I-I-I uses three Intersections. These let you snap the UCS back and forth as rapidly as you can click.

Finally, a tiny LISP statement gets the current UCS name for you, because it's easy to forget where you are in a complex drawing.

3DFACES

Once you've completed a 3D drawing's basic framework, you almost always need to cover over a gap here and there if you're going to plot out a hidden view. This is where the 3dface command comes in. Unfortunately, Autodesk hasn't made it particularly easy to use. Here's another pulldown menu for you (POP10) that will simplify adding visible and invisible faces to your drawing, plus a few other utilities.

```
***POP9
[3-DIMEN]
[3DFACE]^C3DFACE
[CHG 3DFACE]^P(COND ((NULL C:CHFACE)
   (LOAD "CHFACE")));CHFACE
[Inv. 3DFACE]^C3DFACE;I;\I;\I;\I;\;
[Inv. 3DF/int]^C3DFACE;I;INT;\I;INT;
   \I;INT;\I;INT;\;
[4-PT 3DF/int]^C3DFACE;INT;\INT;
   \INT;\INT;\;
[ELEVATION]^CELEV
[THICKNESS]'SETVAR THICKNESS
[ZERO THICKNESS]'SETVAR THICKNESS 0
[3DFACES ON]'SETVAR SPLFRAME 1
[3DFACES OFF]'SETVAR SPLFRAME 0
.xy
.yz
.xz
[V3DLIN]^CLINE;\.XY;@;\;
[SOLID]SOLID
[CHANGE E,T]^CCHANGE;\;P;E;\T;\;
[3D OBJECTS]^P(COND ((NULL C:CONE)
   (PROMPT "Loading...")
   +(LOAD "3D")))^P $I=I3D $I=*
[HIDE]^CHIDE
```

The first command is the unchanged 3dface, just in case you need. The next, CHG 3DFACE, loads CHFACE.LSP (which comes with AutoCAD) and lets you edit the vertices of a 3dface. The INV 3DFACE draws faces that will be invisible if 3DFACES OFF is selected (the variable SPLFRAME is set to off, or 0). The next command draws an invisible 3dface using the Osnap Intersection tool for all four corners. The next draws an ordinary 3dface in the same manner.

Elevation and Thickness are the same commands that were in previous releases. They still have lots of use left in them yet.

The 3DFACES commands set the visibility of faces drawn with the I (invisible) option. You'll only see the effect after a regeneration or a Hide command.

The XYZ filters are handy for feeding a particular coordinate to a new entity, and the V3DLINE draws a vertical 3D line from any chosen point (you type in the Z coordinate, or 3D length). If you use it in a plan view, the line rises vertically out of the screen and you'll just see a dot.

The Change command is preset to deal only with Elevation and Thickness of an entity. It makes editing very quick.

The 3DOBJECTS command loads the domes, dishes and so forth from 3D.LSP, which comes with AutoCAD.

Expanding

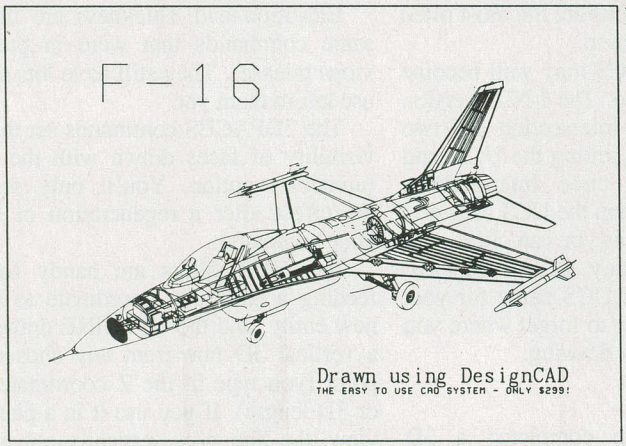
If you've found these macros useful, you'll probably want to continue on adding to your menu, and eventually write a full-blown one of your own. One of the most useful techniques is to have the screen sidebar change to accompanying parameters for a selected pulldown. For instance, in the UCS pulldown I've omitted the rotate-UCS function (X/Y/Z). You could add this command and have it display the most popular angles in the sidebar. Here are some hints to get you off and running:

The pulldown command should be [Rotate UCS]^CUCS $S=UCS. The screen menu should be called **UCS and should begin with X, Y, and Z, each on a separate line. Then add a list of angles, such as 10, 30, 45, 90, etc.

CAD

NEW PRODUCTS

☐ **American Small Business Computers** has released DesignCAD 2D version 4. The company seems confident that the update will make DesignCAD the most powerful CAD program available for a PC computer. A programming language (BasicCAD) allows the user to run BASIC programs to customize the package. The update also features multiple work windows, new dimensioning formats, a customizable screen, and digitizer templates. DesignCAD 2D version 4.0 also has improved mouse support and special "rubber-band" features. The update requires 640K of RAM memory and a hard disk.



The company also announced that a version of DesignCAD is available for the Apple Macintosh, combining the functionality of DesignCAD 2D and DesignCAD 3D.

American Small Business Computers, 327 So Mill St, Pryor, OK 74361; Ph: (918) 825-4844; Fax: (918) 825-6359.

Circle No. 75 on Reader Service Card

☐ **Ajida Technologies** has introduced PlotView version 2.5 for Windows, a utility program for viewing, printing and cutting/pasting Hewlett-Packard Graphics Language (HP-GL) plot files. PlotView runs under both versions 2.1 and 3.0 of the Microsoft Windows operating environment.

Using PlotView, users can examine and manipulate graphics created in drawing, paint or CAD/CAM programs and saved as plot files. Plots can be displayed on the screen, output to a graphics printer, or pasted into documents and reports.

Other PlotView features include scaling, rotation and scrolling; plot size selection; emulation of 5 plotter models; selectable pen colors and widths; zoom in and out; output to laser, inkjet and other printers; new proportional system font; direct access to 16 Mb of memory in Standard or 386 Enhanced mode and up to 64 Mb of virtual memory in 386 Enhanced mode by swapping memory pages to disk.

Ajida Technologies Inc, 613 Fourth Street, Santa Rosa, CA 95404; Ph: (707) 545-7777; Fax: (707) 575-3210.

Circle No. 76 on Reader Service Card

☐ **ISICAD Inc** has CADVANCE version 4.0, a PC-CAD software developed specifically to allow users to work collectively on projects in a network. According to ISICAD, the software permits information and peripheral sharing across the network while offering built-in control and security to ensure data integrity.

Reference files enable users to access several base drawings — with layer control — as a background for their current drawings, but prevent them from editing or changing the base drawing. Security is enhanced through passwords attached to drawings. CADVANCE also offers 2D/3D CAD functionality and direct links to non-graphic databases.

ISICAD Inc, 1920 West Corporate Way, PO Box 61022; Ph: (714) 533-8910; Fax: (714) 533-8642.

Circle No. 77 on Reader Service Card

☐ **Advance Software Design Solutions** is introducing RESOLVE, software to correct reading or drawing distortions that might arise when digitizing drawings for use in CAD systems. The company says most digitizing boards often cannot reference their measurements to a distorted grid or coordinate system. RESOLVE allows a designer to digitize drawings and grid lines with a digitizing board. The software checks and corrects each measurement against the drawing grid. Advance says the result is fast, accurate CAD data.

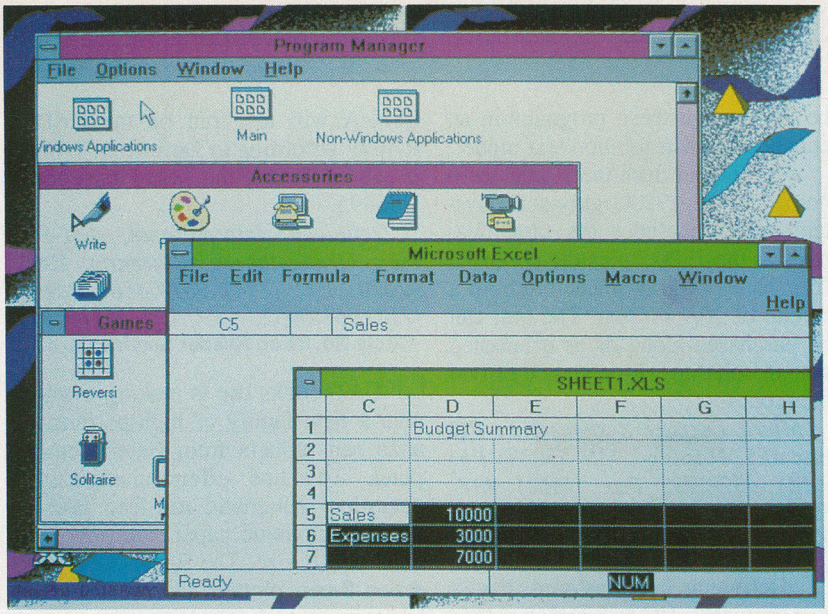
RESOLVE works with CAD systems that have an IGES translator and a digitizer board. The CAD system need not be PC-based, but the IGES files must be placed on an IBM PC or compatible with a DOS environment.

The company says RESOLVE would be most useful for automotive, mechanical design, and tool and die making shops where drawings often have complex surfaces and are defined by several curved sections. The quality of surfaces can be maintained by using the RESOLVE software to correct any distortions in the sections which may exist on the drawing. The RESOLVED surface information can then be used in the CAD design environment as reference surfaces, or the CAM environment to make computer tool paths for milling machines, etc.

Advance Software Design Solutions, PO Box 126, Station B, London, ON N6A 4V6; Ph: (519) 657-1605.

Circle No. 78 on Reader Service Card

☐ **AutoSIGHT Inc** is bringing out AutoSIGHT Compare 2.0, a PC software tool for checking and comparing drawings produced on CAD systems. The update is now compatible



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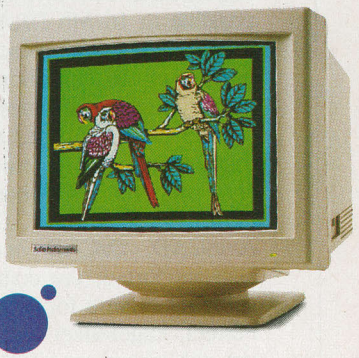

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SII
Seiko Instruments

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*Seiko Instruments USA, Inc., PC Products Division, 1144 Ringwood Court, San Jose, CA 95131, (408) 922-5900. *Interlaced and Non-Interlaced. Trinitron and MAC are registered trademarks of Sony Corporation and Apple Computer, Inc. respectively. Specifications subject to change without notice. © 1990*

with more than 190 printers, requires 450K of free memory, offers a user-configurable environment, and is network compatible.

AutoSIGHT Compare 2.0 provides four methods to compare similar drawings residing in AutoCAD and other CAD systems. A composite method provides a color-coded display of differences between similar drawings or versions of the same drawing. A net-difference method erases all common elements between drawings. An overlay method stacks multiple drawings so their differences can be seen and a split-screen method provides a side-by-side comparison. In addition, the enhanced comparison tool permits users to view differences by turning layers on or off and by panning and zooming areas of the drawing containing differences.

AutoSIGHT Compare 2.0 works with DWG and DXF file formats, and requires 512K and MS-DOS 3.0 or higher. Network versions are available.

AutoSIGHT Inc, PO Box 362086, Melbourne, FL 32936-2086; Ph: (407) 242-5865.

Circle No. 79 on Reader Service Card

☐ **Micro Display Systems Inc** has introduced the Genius 1920C, a video controller card that is compatible with multi-scanning monitors running between 31 and 65 KHz, displaying 1280x1024 resolution. The card can be purchased as a complete system offering a choice of two monitors or as a board-only option. The board incorporates a 32-bit microprocessor running at 60Hz. Standard memory is 2 Mb VRAM and 2 Mb DRAM, with memory expansion possible to 16 Mb DRAM. Features include 256 colors selectable from a palette of 16.7 million and VGA pass-through capabilities.

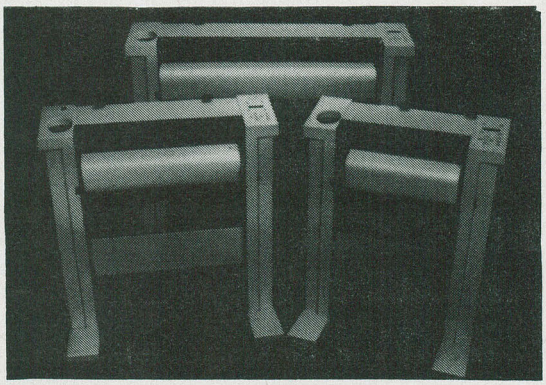
The 1920C is based on the Texas Instruments 34010 microprocessor and supports TIGA-based applications plus Windows 3.0 and GEM. AutoCAD, OrCAD and Halo are also supported; the company is developing drivers for Ventura, WordPerfect, PageMaker and other desktop publishing programs. Users will be able to run these programs in an enhanced high-resolution text mode.

An offshoot from the 1920C technology is the 1920G gray-scale system, which includes the same features as the 1920C plus the option of 256 shades of gray selectable from a palette of 16.7 million. The unit can be purchased alone or as a bundled system solution with a choice of two monitors.

Micro Display Systems Inc, PO Box 455, Hastings, MN 55033; Ph: (612) 437-223; Fax: (612) 437-7325.

Circle No. 80 on Reader Service Card

☐ **Definicon International** has a new low-cost VGA board for PCs that delivers high-resolution graphics comparable to those of the IBM 8514/A and adapters based on the Texas Instruments TIGA interface specifications. The CAD RACE (Resolution and Color Enhanced) board employs RAMDA (digital analog converter) for anti-aliasing and for better color capabilities. (Anti-aliasing is a technique used to smooth the jagged edges of lines, circles and other non-rectangular objects drawn on a CRT screen.)



Definicon says the board generates two to three times the numbers of pixels that can be represented on-screen by conventional 1024x768 VGA graphics boards, producing flicker-free resolutions of near-photographic quality, in better color. CAD RACE also increases the number of colors displayed on-screen to 800,000 from the 256 colors normally associated with VGA technology.

A software-based Display List Processing feature designed for AutoCAD users enables redraws to be performed faster. This feature supports AutoCAD release 9 and 10, as well as AutoCAD 386. In addition to AutoCAD, any software that observes the requirements of the IBM 8514/A will also run on the CAD RACE, according to Definicon. With 1 Mb of RAM, the board lists for US$495.

Definicon International, 181-B West Orangethorpe, Placentia, CA 92670; Ph: (714) 961-0438; Fax: (714) 961-0952.

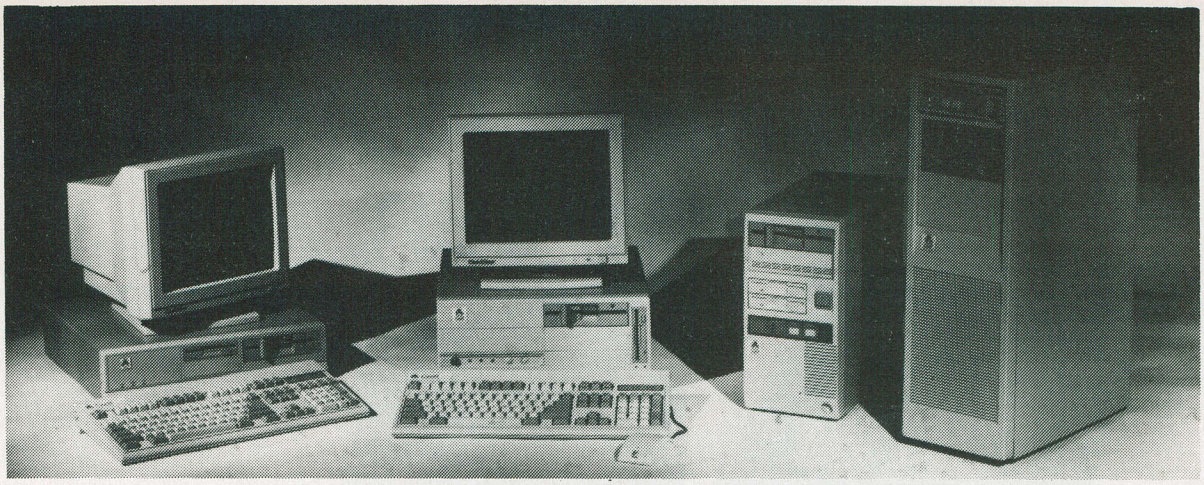
Circle No. 81 on Reader Service Card

☐ **CADworks Inc** is making available a new family of high-performance pen plotters from Enter Computer. The line offers unattended operation, automatic roll-feed take-up and automatic paper sizing in A, C, D and E size. The Encad SP4800 series 8-pen plotters offer a choice between manual or automated operation with a combination of automated frame advance plus motorized roll-feed and take-up. CADworks said the plotters are faster and more efficient due to further development of their VLSIC chip, incorporation of a 68000 microprocessor, and addition of a 512K buffer (upgradeable to 2 Mb with standard SIMMs).

The company says the SP4800 series is designed for more precise arcs and angles, letters and numbers. The series works with most CAD software including AutoCAD, VersaCAD and other HP-GL-compatible programs, and emulates most HP plotters. The Macintosh is also supported. The Encad SP4810 plots A-C drawings, the SP4820 plots A-D, and the SP4830 plots A-E sizes.

CADworks Inc, 1020 Denison Street, Suite 114, Markham, ON L3R 3W5; Ph: (416) 470-6616.

Circle No. 82 on Reader Service Card



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the grid would result in a large change in current through the tube.

With the addition of a grid, three element tubes... "triodes"... were capable of amplification.

In Britain, tubes came to be referred to as "valves," which is probably a much more descriptive name for them. You might want to think of them as such if it helps to understand what they're up to. A tube behaves very much like a valve regulating the flow of a stream of electrons.

Triodes encounter several problems in real life. As the frequency of the signal being amplified increases, the amount of time the electrons flying around between the cathode and the anode have to change direction begins to decrease. After a point they begin to grow confused... they cannot travel between the grid and the anode in the time between cycles of the waveform being amplified and the tube effectively ceases to work. One way around this is to make all the elements and the spaces therein smaller, but smaller tubes can handle less power. Another is to install a second grid.

There are few things more poetic than a digital guitar feeding digital effects run through a digital preamp driving a Marshall tube amplifier.

A tube with two grids... a tetrode... overcomes the capacitive effects of a triode by having a negative grid between the principal signal grid and the anode. The electrons passing the primary grid are repelled from the second grid and can make the trip in a shorter time than they would in a straight triode. Tetrodes can, thus, work at higher frequencies than triodes, all other things being equal.

Unfortunately, tetrodes have a number of peculiar linearity characteristics which can only be solved with... yes, another grid. The resulting tube, a pentode, gets around the frequency and power limitations of a triode without encountering any of the peculiarities of a triode. The majority of vacuum tubes in use at the onset of solid state technology were either triodes or pentodes. Tetrodes had been largely relegated to somewhat exotic radio frequency applications.

Megavolts and Nanoamps

The voltages applied to vacuum tubes would make most solid state devices nervous. A typical preamplifier tube, such as a 12AT7 dual triode, might have a hundred and twenty-five volts on its anode, or "plate," and a third of an amp coursing through its filaments to heat the cathode. Power output tubes such as the venerable 6L6 power pentode... the loud bits of many audio amplifiers... usually run with about three hundred volts on their plates and almost an amp of heater current. A typical amplifier would need at least two of them... my favourite guitar amp uses four.

A fairly sophisticated amplifier... at least by tube standards... may include a dozen tubes per channel. This, in turn, requires a large and exceedingly heavy power transformer to supply the multitude of voltages needed to run the beasts. Finally, power tubes are high impedance devices... you can't connect them directly to a speaker. Instead, the tubes must drive yet another large transformer.

Despite their almost mythical status as audio components these days, tubes are decidedly funky things. The pounding of electrons into a tube's anode creates noise. Vibrations travelling through the metal chassis of an amplifier in turn vibrates the elements of the tubes therein, producing all sorts of microphonic effects... occasionally feedback. The characteristics of tubes change as they get hot, and as they age. They ring, they clip, they oscillate and, having somewhat large metal pieces they frequently act as antennas and pick up local radio stations. Their frequency characteristics are irregular and they have non-linearity problems. Finally, just when you get everything working right, they burn out.

The distortion characteristics of tubes are actually what still endears them to musicians... that, and their ability to put out lots of sound. A straight electric guitar played through a straight amplifier isn't actually all that interesting. Tube amplifiers add "warmth" to a guitar by distorting the signal in subtle ways. The distortion of tube sound isn't as radical as that of a fuzz box, and because tubes aren't actually terribly linear... especially when they're driven to their limits... the nature and amount of the distortion they introduce can be controlled intuitively by the person playing guitar.

The other useful characteristic of tube amps for guitarists, their ability to handle large amounts of power, is actually what they're intended for in stereo amplifiers as well. When a transistor is driven beyond its rated output power, it clips the signal. Because contemporary solid state output devices are very fast, they clip very cleanly. Transients and other loud, short phenomena also get clipped cleanly. The result is the introduction of a lot of high frequency energy into the sound belting through the amplifier in question, which sounds harsh and unpleasant.

A tube amplifier, on the other hand, has a big inductor which stores energy for its output stage, this being the output transformer. When you drive a tube amplifier to clipping, the tubes tend to round out the clipped waveform... as well as adding some still more interesting distortion to it. The result looks like anchovies and catnip on a 'scope, but it sounds better.

Tube Sound

An electric guitar is only half an instrument... if you don't believe this, try playing one with no amplifier. A guitar amp is more than just a box to make the guitar audible. Guitarists choose amplifiers to some extent depending upon how they want the amp to colour their sound.

Admittedly, this is less true than it used to be. Many musicians use pretty bland solid state amplifiers and then lots of effects pedals to colour their sound.

Stereo amplifiers aren't intended to colour the sound they amplify. Most of the characteristics which guitarists cling to as they tape the shattered remains of their tube amplifiers together for just one more gig are quite the opposite of what one wants in a stereo. A lot of the things which

see **Tubes**, *page 38*

FEATURE

A Microcomputer Based Wireless Controller

by Donald Wilcher

The obvious method of computer control systems consist of sending signals from the host system to the device to be control via cabling or transmission wires. This method of data transmission is quite effective for short run distances but is quite cumbersome for longer cable routings due to signal loss or degradation and cost of cable length. Using a "wireless" technique for transmitting data is much more cost effective because the extensive amount of cable to run is not necessary. Signal degradation is almost nil because depending on the type of transmitter/receiver used, these units are capable of sending and receiving data a couple of meters without having to worry about voltage drops across a transmission wire. Although a Tandy Colour Computer was used in the project as the host system, any personal computer can be utilize by substituting output ports and Basic Language commands of the Colour Computer to the appropriate output ports and language commands of the individual's system.

RADIO CONTROL TRANSMITTER AND RECEIVER

In order to control real world devices without the use of wires, a radio control transmitter and receiver is needed. There are 2 options available to the experimenter when it comes to radio control transmitters and receivers. He or she can either scratch build these units or purchase them at a store. Personally, I prefer to use off the shelf units because it saves time in not having to build then tune both the transmitter and receiver circuits. Besides building them from scratch, in order to tune the units expensive test gear would have to purchase as well. But if you have the time, money, and the patience in building your own radio control transmitter and receiver, then by all means do so because in the long run you'll be able to add more features to these units which will allow you to do more sophisticated control activities with your system. If you decide not to build your own units, then don't despair. A good place to start in finding already built R/C units is at your local community flea market. The average cost of an R/C toy is about $8.00. If you go to TOYS R US or Children's Palace, the cost will range from $10-$15. So whatever you decide to do, the end result is you will not be making a major investment. The units that I purchased for this project cost about $10.00 and I have the ability of controlling a small dc motor to rotate in both forward and reverse directions. The units used were NIKKO R/C devices. The figures in 1 and 2 illustrate the physical appearances of the transmitter and printed circuit boards. The units you decide to use will be quite different in appearance but the basic function of controlling a dc motor will be the same.

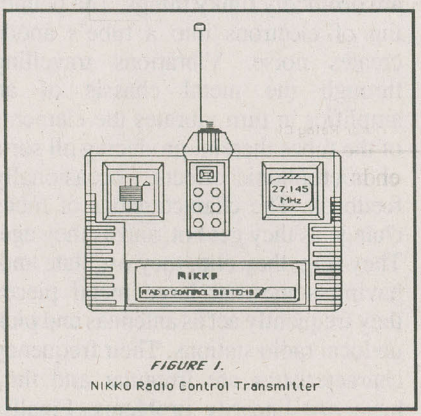

FIGURE 1.
NIKKO Radio Control Transmitter

THE CASSETTE MOTOR RELAY OF THE COLOUR COMPUTER

As mentioned earlier, the Tandy Colour Computer was used as the host system for this project. Basically, the CoCo (short for Colour Computer) was used as a smart terminal for entering instructions on how the device is to be control. The usage in which I intended the wireless controller to interface with was a table top mobile platform in which I

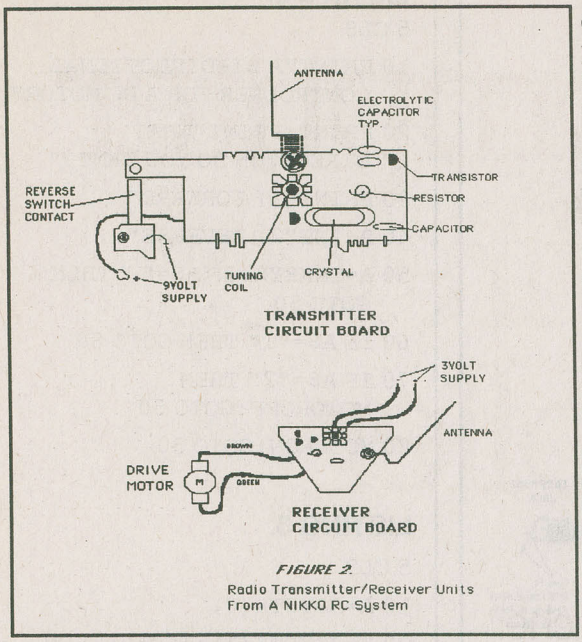

FIGURE 2.
Radio Transmitter/Receiver Units From A NIKKO RC System

constructed out of the ROBOTIX Construction set made by Milton Bradley. The platform consisted of a flat square base with 4 wheels attached to it. Out of the 4 wheels, 1 wheel was attached to a geared motor. This motor was then interfaced with the receiver circuit board of the NIKKO R/C system. The transmitter circuit board was connected to the CoCo via the Cassette Motor Relay

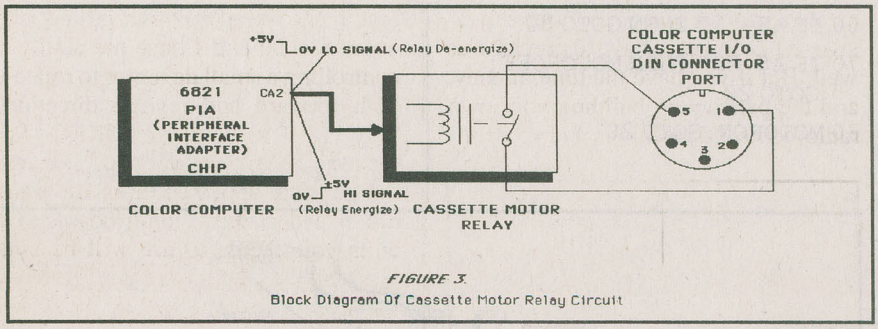

FIGURE 3.
Block Diagram Of Cassette Motor Relay Circuit

which is inside of the computer. The Cassette Motor Relay is controlled by a 6821 PIA (Peripheral Interface Adapter) chip. The PIA has a Control Address Line (CA) which controls the Cassette Motor Relay. The CA2 must be configured to output a high or a low signal to control the motor relay. When CA2 sends a high signal (+5V), the relay coil is energized thereby closing the relay contacts. Once the contacts are closed, this completes the circuit connected across pins 5 and 1 of the DIN Cassette Connector. When CA2 sends a low signal (0V), the contacts open and the circuit connected to pins 1 and 5 of the connector are open. It is this point(s) where the radio transmitter will be connected to the computer which will control this unit. Figure 3 illustrates the block diagram of the Cassette Motor Relay circuit of the CoCo. NOTE: If you are using a VIC 20 or Commodore 64 Computer, this technique can be used with minimal substitutions in the radio control transmitter interfacing. Consult your technical reference manual for further information.

PUTTING IT ALL TOGETHER

Now that all of the pieces of this high tech puzzle have been discussed, we are now ready to put it all together. In order to connect the transmitter to the CoCo, it needs to be modified just a tad. Basically, a pair of wires need to be soldered across the switch of the transmitter. After the wires have been soldered across the switch, they need to be routed outside of the transmitter's case via a drilled pass-through hole in the case. The other ends of the wire leads need to be connected to pins 1 and 5 of the Cassette Port. Two methods of interfacing these leads to this port are using a DIN Male Connector or a jack for the Cassette Motor Plug. In Figure 4 a DIN Connector (male) will be soldered to the external switch leads of the radio transmitter as illustrated or as shown in Figure 5, a jack would be used to connect the CoCo to the transmitter via cassette cable assembly. Depending on availability of parts, both methods will work just fine.

Once the transmitter has been connected to the CoCo by the methods described, the system is ready to be tested. Figure 6 illustrates how the receiver circuit board should be modified for testing the system. Depending on the R/C system that you use, there should be a pair of leads for the motor and a pair for the power source. A silicon diode should be added to one of the output motor leads. This will then allow the receiver to operate in a unidirectional mode (one direction) thereby making it possible to energize the LED driver circuit for indicating that the wireless controller is functioning correctly. The program in Listing 1 is used for testing the radio transmitter and receiver units of the system.

APPLICATIONS

The following examples will illustrate the versatility of this controller and hopefully will spark other ideas as well.

Unidirectional Control Of A DC Motor

The circuit diagram in Figure 7 shows how to control a dc motor in one direction. As mentioned earlier, the silicon diode is used just for this purpose. The program in Listing 1 can be used to control the motor.

Bi-Directional Control Of A DC Motor

To have the ability in controlling the direction (Forward/Reverse) of the motor, the silicon diode must be removed. This will then allow current to flow in both direction thereby changing directions of the motor's shaft. The program in Listing 2 allows the transmitter to work in such a manner.

Joystick Control Of A DC Motor

Instead of using the keyboard to initiate commands in controlling the motor, a joystick can be used instead. The program in Listing 3 is used in accomplishing this task.

It is hoped that these few examples will spark other ideas in using this controller. As previously mentioned, I used this controller for experimenting with a mobile platform. This experimentation with the unit has sparked applications in using the wireless controller with robots. One idea that comes to mind is to have an input sensor capable of detecting metal where if a robot comes

in contact with a metallic object it will change direction.

NOTE: If you want to learn about robots and how to build your own "HOME BREW" machines, join the Experimental Robotics Group. Membership includes a monthly newsletter *ROBOTICS NOW* packed with construction tips, robot mechanics, design programs and advance electronic/computer control circuits and systems. Access to technical advice in the areas of design, construction and testing of system software/hardware of robots and intelligent machines will be available. Cost of membership is just $20.00 (Canadian Membership $24.00 in U.S Dollars). Send membership fee to the author, Donald Wilcher at the address below:

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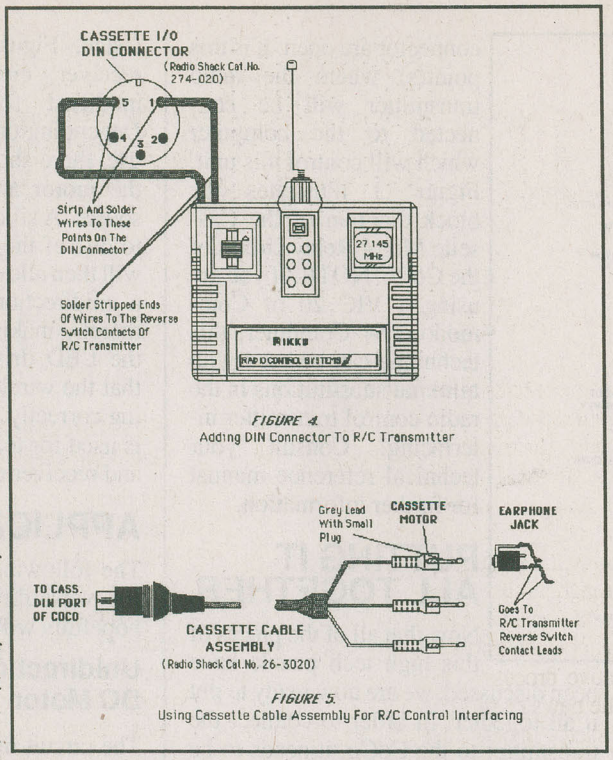
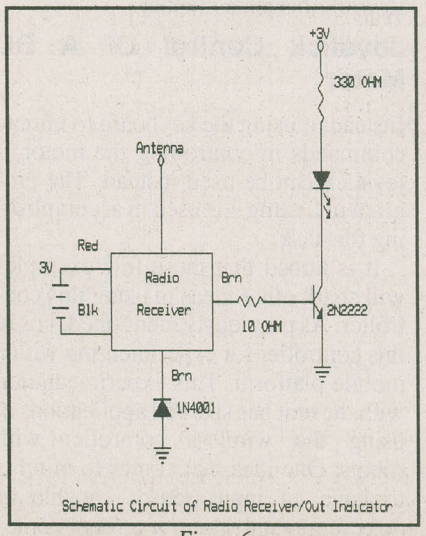


FIGURE 4.
Adding DIN Connector To R/C Transmitter

FIGURE 5.
Using Cassette Cable Assembly For R/C Control Interfacing

LISTING 1.

```
5 CLS
10 PRINT"TEST PROGRAM FOR
   COCO-TO-RADIO TRANSMITTER
   INTERFACE"
20 PRINT:PRINT"DO YOU WANT
   TO:"
30 PRINT"1) TURN ON CIRCUIT"
40 PRINT"2) TURN OFF CIRCUIT"
50 A$=INKEY$:IF A$="" THEN
   GOTO 50
60 IF A$="1" THEN GOTO 80
70 IF A$="2" THEN MOTOROFF:
   GOTO 20
80 MOTORON:GOTO 20
```



Schematic Circuit of Radio Receiver/Out Indicator

Figure6

LISTING 2.

```
5 CLS
10 PRINT"A BI-DIRECTIONAL
   CONTROLLER FOR A DC MOTOR"
20 PRINT:PRINT"WHAT
   DIRECTION DO YOU WANT?"
30 PRINT"1) FORWARD"
40 PRINT"2) REVERSE"
50 A=INKEY$:IF A$="" THEN
   GOTO 50
60 IF A$="1" THEN GOTO 80
70 IF A$="2" THEN
   MOTOROFF:GOTO 50
80 MOTORON:GOTO 50
```

LISTING 3.

```
5 CLS
10 A=JOYSTK(0)
20 B=JOYSTK(1):IF B=0 THEN
   MOTOROFF:PRINT@256,
   "MOTOR IS ROTATING
   FORWARD"
30 IF B=63 THEN
   MOTORON:PRINT@256,
   "MOTOR IS ROTATING
   REVERSE"
40 GOTO 10
```

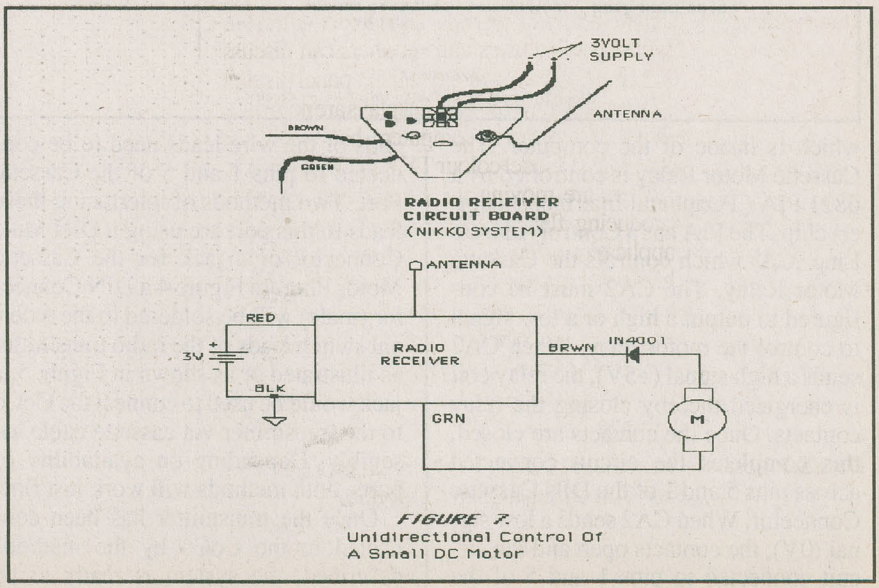


FIGURE 7.
Unidirectional Control Of
A Small DC Motor

Coming Events

Event: **Convergence 3** International Forum on the Moving Image

Description: Since the first Convergence conference was held in 1984, the audio-visual scene has undergone considerable change. Moving image technology has made impressive strides. This year, Convergence 3 intends to take stock of these changes with the help of speakers from the world over. The 1990 forum will bring together people from the moving image industry interested in discussing a major dimension of their current field of activity. What is the impact of this evolution on the creative process? Does media technology cover the news or make it? What influence will so-called "hypermedia" technology have on the film television and video industries? Organized in cooperation with the Cinémathèque québécoise, the debates and conferences scheduled during the two days of meetings will make it possible to examine different experiences and viewpoints and to ponder the issues.

Date & Place: December 3 & 4 1990, Montreal Quebec

Contact: Convergence, 335 boul. de Maisonneuve East, Montreal, Quebec H2X 1K1 Tel: (514) 842-9763

Event: **Flat Information Displays Conference & Exhibition**

Description: This event will provide an interactive forum where display users and suppliers can discuss the strategic issues facing the flat panel display industry today. Flat Panel Displays are now used in portable personal computers, hand-held and small table model colour TV receivers. Display makers are moving up the learning curve in producing flat panels for these high volume applications. This will result in lower prices and higher penetration rates for flat panels into other applications as well. A number of different display technologies compete for each application area and market segment. All of the important display technologies will be covered at this meeting.

Date & Place: December 11 & 12, 1990, Santa Clara Convention Center, Santa Clara, California

Contact: Murray Disman, Information Associates, 1259 El Camino Real #231, Menlo Park, CA 94025, Tel: (415) 322-0247 Fax: (415) 322-0469.

Event: **1991 International Winter Consumer Electronics Show®**

Description: Get fiscally fit for 1991 with vitamin CES. This January, get in shape at Winter CES. We'll be dishing up a healthy feast of fresh new products and a well-balanced diet of enriching workshops. Winter CES is a super-charged place to see all the latest products, meet new suppliers, learn about new promotional programs, discover new merchandising techniques, learn what price points will be and motivate yourself while enjoying your stay in Las Vegas.

Date & Place: January 10-13, 1991, Las Vegas Convention Center, Las Vegas Hilton, The Mirage, Riviera Hotel and Sahara Hotel, Las Vegas Nevada

Contact: Consumer Electronics Shows, 2001 Pennsylvania Avenue, NW, Washington, DC 20006-1813.

Event: **NEPCON West**

Description: The National Electronic Packaging and Production Conference West will feature the largest conference program in the 29 year history of NEPCON. The expansion of the program to include 117 sessions will mark the first time that the conference program will span a full 5 days. The 5 technical tracks will include: design, packaging, fabrication, assembly and test. Highlights from the technical program will include 6 sessions on multi-chip technology, 12 sessions on environmental issues and CFC cleaning alternatives, as well as sessions in each track devoted to surface mount technology, design for manufacturabilty, and contract manufacturing. In addition, the program will also include a management track that will feature a special session entitled, "How to Capture Your Share of the EEC's 1992 Bounty."

Date & Place: February 24-28, 1991 Anaheim Convention Center, Anaheim, California

Contact: Michael Critser, Conference Manager, Cahners Exposition Group, 1350 E. Touhy Ave., Des Plaines, IL 60017-5060, Tel: (708) 299-9311.

Event: **WESTEC '91** Western Metal and Tool Exposition & Conference

Description: The Japanese call it *kaizen*. In the U.S., it's known as "continuous improvement." Next year, its concepts, applications, and advantages highlight WESTEC, the Western Metal and & Tool Exposition and Conference. Sponsored by the Society of Manufacturing Engineers (SME), ASM International, the American Machine Tool Distributors' Association, and NMTBA — The Association for Manufacturing Technology, WESTEC '91 (an Advanced Productivity Exposition) takes place March 18-21 at the Los Angeles Convention Center, and will be 1991's largest machine tool and manufacturing show.

Date & Place: March 18-21, 1991, Los Angeles Convention Center, Los Angeles, CA

Contact: Society of Manufacturing Engineers, Event Public Relations Department, One SME Dr., P.O. Box 930, Dearborn, Michigan 48121-0930, Tel: (313) 271-0777.

Event: **Electro®**

Description: Electro, the East Coast's largest electronics conference and exhibition, will return to New York next Spring with an expanded international focus that will explore business and technology issues facing the worldwide electronics community. The theme for Electro/International, will be "World Class Engineering Solutions," and the show will address the tremendous economic and technological changes occurring throughout the world, and the resulting integration of the global electronics marketplace. More than 20,000 engineers, engineering managers and corporate executives from around the world are expected to attend Electro/International.

Date & Place: April 16-18, 1991, Jacob K. Javits Convention Center, New York City.

Contact: Electro, 8110 Airport Blvd., Los Angeles, CA 90045 Tel: (213) 772-2965 Fax: (213) 641-5117.

Event: **NCGA '91**

Description: The 12th annual conference and exposition sponsored by the National Computer Graphics Association is dedicated to all applications of computer graphics. NCGA '91 will feature more than 200 exhibitors and a comprehensive conference program geared to these major computer graphics user areas: engineering, architecture, graphic arts and publishing, MIS/IRM, Marketing, sales and finance, research and development and manufacturing and operations. The National Computer Graphics Association is a non-profit organization of individuals and major companies dedicated to developing and promoting the computer graphics industry and to improving applications in business, industry, government, science and the arts.

Date & Place: April 22-25, 1991, McCormick Place North, Chicago, Illinois

Contact: National Computer Graphics Association, 2722 Merrilee Drive, Suite 200, Fairfax Virginia 22031, Tel: (703) 698-9600 Fax: (703) 560-2752

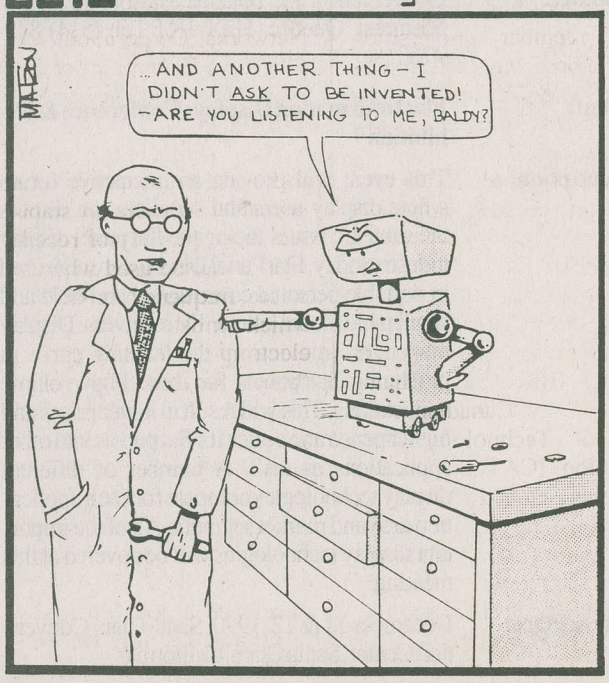
Event: **SPAA '91**: Third Annual ACM Symposium on Parallel Algorithms & Architecture

Description: The Association for Computing Machinery plays a leading role as the representative society of the computing scientists. The majority of ACM's, over 75,000 members, are active participants in ACM's Special Interest Groups (SIGs), considered to be the best technical resource groups in the computing field. The SIGs' focus is on creating technical forums for the exchange of the latest research findings, technical notes, and other professional data; and on disseminating that information through referred publications and technical conferences.

Date & Place: July 21-24, 1991, Mariott Hotel, Hilton Head, SC

Contact: Tom Leighton, MIT Math Dept., 545 Technology Square, Cambridge, MA 02139, Tel: (617) 253-3662 email ftl@math.mit.edu ❐

bots by Ron Matzov



The world's first personality prototype robot and its inventor: shown here two minutes after its creation, ten seconds prior to its destruction.

Industry News

TRIO Researchers Rewarded

The Telecommunications Research Institute of Ontario (TRIO) has rewarded research teams for creating innovations of great potential industrial utility or commercial value. The 1989 competition saw seven innovations submitted and involved 43 people from five of TRIO's six Research Thrusts.

TRIO is a not-for-profit research consortium investigating the technologies that will shape telecommunications development and usage over the next decade. TRIO research projects are realized through the collaboration of over 250 researchers and students at four member universities (Carleton, McMaster, Ottawa and Queen's) and seventeen member organizations. TRIO is one of the seven Centres of Excellence in research supported by the Ontario Premier's Council.

The awards, which had a minimum value of $10,000 were presented by Dr. Robert Blackshaw, Chairman of the Canadian Advanced Technology Association (CATA), for the following innovations: the Multimedia Radiology Communications System, the CELP Vocoder, the Frequency Synthesizer and the TTCN Workbench.

The Multimedia Radiology Communications System has widespread applications in the field of medical communications. The system allows for more efficient diagnostic communications between clinicians and radiologists. The Multimedia system was developed by a team of twenty innovators at the University of Ottawa under the supervision of Dr. Nicolas Georganas and Dr. Morris Goldberg, and the award was for $10,000.

The CELP Vocoder, developed by Wilf Leblanc and Dr. Samy Mahmoud of Carleton University, is a speech coder based on Reduced Complexity Code Excited Linear Prediction (CELP) Algorithm. The Vocoder, which allows an increased number of phone calls over a given channel, is already in use by Newbridge Networks Corporation and SkyWave Electronics of Ottawa. The award was for $15,000.

The Frequency Synthesizer has applications primarily in radio to stabilize the frequency of reception. It can be used where a stable frequency is needed which must move under electronic control. The synthesizer was developed by Thomas Riley and Dr. Miles Copeland at Carleton University, and this award was valued at $10,000.

The TTCN Workbench (Tree and Tabular Combined Notation) was developed at the University of Ottawa by nine students under the supervision of Dr. Robert Probert and was awarded $10,000. The Workbench allows for the creation of protocol specifications and allows testing and validation of communication protocols.

The panel that evaluated the submissions was made up of 5 leading scientists from industry: Gordon Land of Motorola Information Systems Canada; Mel Thompson of Bell Canada; Peter Rossiter from SkyWave Electronics; Colin Franklin from Spar Aerospace; and Peter Leach of TRIO.

Canadian Paper Mills Get International Recognition

MONTREAL — Two Canadian paper mills, both located in Quebec, have been singled out by European experts as case studies for excellence in predictive maintenance methods.

The studies, carried out by Danish-based D.N. Brown and T. Jensen take an exhaustive look into the operations of Abitibi Price's mill at Alma Quebec and its mill at Kénogami. In both cases, the latest in vibration detection techniques were used to identify possible fault or breakdown areas before damage occurred.

In the case of the Alma mill, a technique known as "spectrum analysis" was used to compare the vibration characteristics of machine bearings in a healthy state with those with potential problems.

At the Kénogami mill, a more comprehensive system known as Crest Factor and Cepstrum Analysis was able to determine not only potential bearing problems but to carry out quality control functions by identifying worn felts and roll surface defects.

The reports conclude that in the case of the Alma mill "literally hundreds of thousands of dollars have been saved by obtaining early warnings of faulty bearings." In the case of the Kénogami mill, the case study reports "a significant increase in both production quantity and quality can be expected from the monitoring system."

Vencap Invests in Audio Products

Vencap Equities Alberta Ltd. announced it has invested $1.5 million in Museatex Audio Inc., a manufacturer and marketer of high-end audio components and systems with operations in Calgary and Montreal.

Museatex Audio Inc. manufacturers a wide assortment of audio components that are specifically targeted to the high-end audio market. The company has patent applications pending for several technical innovations it has developed and is known as a leader in applying digital technology to audio products. Among the components that Museatex

manufactures are pre-amps, power amps, CD players, turntables and various accessories. All provide top-end audiophile quality.

As part of Museatex's strategy, it recently merged with Highwood Audio Inc. of Calgary. Highwood is the only manufacturer of high-end speakers to successfully use single point source planar technology, whereby full-range audio is produced without the need for woofers and tweeters and, correspondingly, the complex mechanisms typically required to coordinate these elements.

Vencap's investment in Museatex is part of a total $3 million investment in the company with Alberta-based Alta-Can Telecom Inc.

"This investment allows the opportunity for two companies to combine their expertise and marketing strengths to pursue a specialized upscale market," says Vencap President R.A. (Sandy) Slator. "There is real growth occurring in the consumer industry for lifestyle products that appeal to the very disconcerting customer."

Museatex plans to become a significant participant in the billion dollar high-end home entertainment market, according to Museatex President Kurien Jacob. "At present, there are very few manufacturers who can provide an integrated home entertainment system in one package."

Vencap Equities Alberta Ltd. is a publicly traded venture capital company listed on the Alberta Stock Exchange. Vencap has committed almost $145 million in venture capital since it was established in 1983. For more information, contact: R.A. (Sandy) Slator, President and CEO, Vencap Equities Alberta Ltd., Tel: (403) 420-1171.

Jobs For Professionals Down Again

Job vacancies for accountants, engineers, scientists executives and other professionals decreased 30% in the last year, according to the Technical Service Council/Le Conseil de Placement Professionnel, an industry-sponsored placement service and personnel consulting firm. The sharpest drops were reported by Manitoba (-49%), Ontario (-41%), and Quebec (-35%). Vacancies in British Columbia decreased 24%, but those in Alberta zoomed 43%.

Too few reports were received from the Atlantic provinces, Saskatchewan and the Territories for reliable conclusions to be drawn. The council's quarterly survey covers openings with manufacturing, mining, construction and consulting firms, but does not reflect openings in institutions and government.

Alberta's stand-out performance seems due to the natural gas and pipe-line sectors, supplemented by the province's diversification. Soaring oil prices might bolster the economy in 1991, but oil companies are wary of increasing exploration budgets until it is certain that the high prices will be sustained. Several have had layoffs.

In British Columbia, telecommunications and consulting engineering firms have had significant layoffs. As in other provinces, small shortages of specialists persist.

In Quebec, accountants, hardware and software engineers with specialized experience are in demand in spite of a slack market.

In Ontario, government expenditures on transportation facilities and general concern with the environment will ensure a continuing shortage of highway designers, transportation engineers and civil engineers with environmental experience, in spite of the general decrease in vacancies.

The decreases in Ontario and Quebec come at a time when many manufacturers, transportation, financial and venture capital companies are laying off.

"Out-placement firms are swamped with requests from employers to coach their laid-off staff in job hunting skills." Companies know that if they do not treat laid-off staff well, the productivity of the remaining workers will be adversely affected," according to Neil A. Macdougall, president of the Technical Service Council. "This coaching and support also minimizes the risk of wrongful dismissal suits and reduced the time to find a job by about 10%-20%.

"Most middle managers and professionals are finding jobs within four months. To do so requires devoting 40 hours a week to job hunting and making literally hundreds of contacts with prospective employers as well as extensive 'networking'. The time to get a job is expected to lengthen as the economy slows."

Experienced systems analysts and computer programmers are in greater demand than any other occupation. Employers continue to be selective, insisting upon good inter-personal and communication skills and the ability to work with user departments. It is assumed that the almost 3,500 analysts and programmers on unemployment insurance lack these talents or will not move geographically.

A strong demand also exists for experienced electronic technicians and technologists, mechanical sales engineers and civil engineers with environmental, transportation or municipal experience.

Some staff shortages, although small, are so severe that job hunters can get a position within a week.

The survey is one of the few in recent years which has not shown accountants as one of the occupations in greatest demand. Competition continues to be intense for vacancies for vice-presidents-finance and controller, but even junior and intermediate accounting positions now attract more candidates, particularly in Ontario. Traditionally, the profession is one of the most stable and is resistant to layoffs.

The survey identified an unusually large number of occupations with fewer than ten vacancies. These included biologists, zoologists, botanists, contract administrators, market researchers, corporate planners, technical writers, technical illustrators, ceramic engineers, research chemists, chemical technologists, production supervisors, operations researchers, statisticians, mathematicians, foresters, petroleum geologists, geophysicists, safety engineers, industrial hygienists, corporate lawyers, fleet superintendents, metallurgists, welding engineers, mining engineers, personnel trainees and petroleum engineers.

The slack economy has not made it any easier for employers to hire female engineers. Although women with accounting qualifica-

tions and masters' degrees in business administration are common-place, only about 3% of registered professional engineers are female. An estimated 13% of enroled engineering students are female.

Employers are responding by modifying their specifications. One firm sought an engineer with five years' experience in process engineering in the petrochemical industry. It finally hired a female engineer with one year's experience, none of it in process engineering or the firm's industry.

The Council expects the low down in vacancies to continue for several months. However, employers seeking professionals with specialized experience will continue to experience difficulty because of the small number of specialists and their reluctance to move geographically.

Competition for qualified people will be most intense in Toronto. The talent pool there has shrunk as young professional couples have been leaving the city for lower cost areas and people from elsewhere refused to move to the city. Some consulting engineering firms have been moving work from their Toronto offices to out-of-town branches because of their inability to hire staff locally.

The decrease in job openings has encouraged overqualified people to apply for junior jobs. An Ontario firm seeking a specifications coordinator received 57 replies to its advertisements, 46 of them PhD's, engineers and other over-qualified people.

The Technical Service Council/Le Conseil de Placement Professionnel is a unique personnel consulting firm and placement service run by industry. It was set up in 1927 to combat the "brain-drain" to the United States.

The Council specializes in the placement of accountants, executives, engineers, scientists, technologists and personnel, data-processing and sales staff. Over 47,000 men and women have received job offers through the Council at no cost to them. The TSC has offices in Montreal, Toronto, Mississauga, Winnipeg, Calgary, Edmonton and Vancouver. The Council also conducts labour-market studies, advises governments on university and college courses, undertakes relocation counselling and sponsors seminars on personnel subjects. An affiliate, Bryce, Haultain & Associates, specializes in executive search.

For more information, contact: Technical Service Council, 1 St. Clair Ave., E., 10th Floor, Toronto, Ontario M4T 2V7: Toronto - N.A. Macdougall (416) 966-5030, Montreal - A. Sarda (514) 866-2807, Winnipeg - B. Hayes (204) 943-3484, Calgary - C. Plaizier (403) 269-7931, Vancouver - M. Gilchrist (604) 682-8861.

REHABEX '90 Debut a Success

TORONTO — Show organizers for REHABEX '90 say the first ever rehabilitation trade show and conference for health care professionals has been so successful, that it is becoming a major industry event. Over 3,000 people visited this year's two day event, which was held October 10 and 11 at the Metro Toronto Convention Centre. REHABEX '90 featured a wide range of exhibits and special demonstrations, as well as a highly successful series of Assistive Devices Program (ADP) workshops.

Mark Cox, director, Ontario Ministry of Health, Assistive Devices Program says REHABEX '90 was especially successful for his organization. "Our ADP workshops during the show were very well attended, with 800 authorizers taking part in six device categories. A good portion of those attending were new authorizers, which means we managed to substantially increase our numbers in just two days. This will greatly improve public access to government funding for assistive devices. REHABEX '90 provided an ideal venue for us to resource those people and increase our services to the public."

Janet Halenda, show manager, adds, "REHABEX '90 was well received by both participants and visitors. So much so that we have decided to hold two shows next year — one in Montreal and one in Toronto. In addition, because the demand has been so great, we have decided to open REHABEX to the general public next year. This will make it even bigger and better than ever.

"We're very pleased to have met with such success with REHABEX. It's a definite indication of the need for this type of event for the health care industry, and we're looking forward to seeing many more in the years to come."

New Fiber-Optic Network to Link Vancouver Island with Lower B.C. Mainland

MONTREAL — B.C. Tel and Teleglobe Canada Inc., a Memotec company, today signed an agreement to jointly construct and operate a $45-million fiber-optic network linking Vancouver Island with the Lower Mainland in British Columbia. The new system will provide extensive state-of-the-art facilities to serve B.C. Tel's Vancouver Island customers. It will also be linked to the 6,125 mile (9,800 km) fiber-optic Trans-Pacific Cable (TPC-4) joining Canada with Japan, in which Teleglobe is a major partner.

The 315 mile (505 km) network will more than double the existing transmission capability between Vancouver and Vancouver Island. This will allow B.C. Tel to handle the rapidly growing volume of calls between the two locations. In addition, the new system will satisfy the projected demand for television transmission during the 1994 Commonwealth Games in Victoria. It will also enable Teleglobe to better meet Canada's telecommunications needs with other countries of the Pacific Rim, the fastest growing region in terms of traffic growth.

The network will be configured in a figure of eight to ensure maximum reliability of service through alternate routings. It includes two different routes to be built across Georgia Strait.

Construction will begin in the spring of 1991 and the system should be operational by fall of 1992. About two-thirds of the network — 215 miles (345 kms) — will be on land and 100 miles (160 kms) will be underwater. B.C. Tel will construct all terrestrial facilities. The main terrestrial links will be buried using construction techniques similar to those used on the Telecom Canada Lightguide Transmission

System, completed in March of this year. Teleglobe, with its sister company Teleglobe Marine Inc., will be responsible for the construction of the submarine facilities and will bring in a cable ship to lay the cables across Georgia Strait.

H.E.C. – Xerox Announce Study Centre on Quality

MONTREAL — A unique partnership to create a centre for the advanced study of total quality management in business was announced today by one of Canada's premier university business schools, École des Hautes Études Commerciales (H.E.C.) in Montreal, and Xerox Canada Ltd.

Xerox, the winner of the 1989 Gold Quality Award in the Canada Awards For Business Excellence, has donated $250,000 to establish the Study Centre on Quality at H.E.C. The aim of the Centre is to develop and incorporate into educational and management training programs the concept of total quality management.

Senior Xerox executives will also donate their expertise to the Centre over a five-year period.

"This partnership is a real shift away from traditional donations," said Rémi Lacasse, Vice-President of Service Operations for Xerox Canada. "Rather than funding bricks and mortar, this agreement will allow Xerox people hardened in the competitive fires to be directly involved in educating."

He explained the H.E.C./Xerox partnership evolved from a shared desire to prepare tomorrow's business leaders to bring total quality management into every element of business. To this end, programs at the Centre will be open to business people already working in the private sector as well as to students.

H.E.C. Director Jean Guertin explains studies at the Centre will include quality philosophies in management models for implementing total quality programs, benchmarking survey techniques and compensation systems. "We want to pursue total quality on as large a spectrum as possible," he said. "It will not be a once-only deal. Total quality concepts will colour our activities for the next five years."

Guertin said the Centre would not have been possible without Xerox Canada's participation. Support provided by the company will go toward activities including professional development for professors, development of a quality reference library, establishing a network of industrial partners and developing educational materials.

H.E.C., founded in 1907, is affiliated with the Université de Montréal and offers under-graduate, graduate and post-graduate degrees in business administration and management sciences. It has over 10,000 students registered every year, and the largest full-time business school teaching staff in Canada, 180 professors.

Xerox Canada Ltd. is a major supplier of office technology, equipment and services that facilitate the creation, reproduction , distribution and storage of documents. Xerox also provides supplies, equipment maintenance, financing, and customer education.

Xerox Canada Ltd. is strongly committed to educational support and has donated almost $3 million in funding to Canadian universities coast to coast. The company also has several programs of direct involvement with students at the secondary school level.

The Université de Montréal, École Polytechnique and École des Hautes Études Commerciales are conducting a fund-raising campaign called "Share the Vision." Xerox Canada Ltd's support is in line with this campaign.

Improved Access to Technology Information

QUÉBEC — Consumer and Corporate Affairs Minister and Minister of State for Agriculture Pierre Blais today announced two projects which will improve the dissemination, among businesses throughout Canada, of technology information contained in patents.

The first of these projects is the automation of Canada's Patent Office.

"Eventually this modernization will allow business people from all regions to access directly the country's most important technology database, and to do so from their own personal computer," explained Mr. Blais.

Patents are currently filed in Consumer and Corporate Affairs Canada offices in Hull, Quebec, on more than six miles of shelves.

"For small and medium-sized businesses with limited resources, automation of the Patent Office will improve their access to technological information and encourage technology transfer. This can improve productivity and competitiveness," noted the Minister.

Automation will stimulate research and development in Canada and can help business identify foreign markets.

The cost of the project is $74 million over six years. This expense will be offset primarily by fees charged foreign users.

The project's first stage will be completed in 1992 when, for example, all incoming applications for patents will be logged electronically. Completion of the project is timed to coincide with the automation of the patent offices of most of Canada's major trading partners, including the United States, Japan and several members of the European Community.

Scientists Receive National Statistics Award for Revelations of Challenger Disaster

MORRIS TOWNSHIP, N.J. — Three Bellcore scientists statistically proved that the probability of the space shuttle Challenger disaster at launch time would have been significantly lessened if the launch was postponed until the outside temperature had risen considerably. Their findings were published in the Journal of the American Statistical Association, December 1989.

Now for their work, the researchers have been chosen to receive the 1990 Outstanding Statistical Application Award from the American Statistical Association (ASA) — the only such award given by the association in the past three years:

The scientists found that the temperature at launch

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Electronic Time Capsules for A.D. 10,000

by George Lawrence

The history of time capsules dates back to ancient Babylon and Egypt. Statuettes or inscriptions sealed into temple foundations comprised the earliest forms. These seminal beginnings eventually culminated in Megalithic architecture of enduring grandeur, attesting to the achievements of great civilizations.

Today *electronic* time capsules are finding new custom markets and a niche in history. Small but elegant designs (Fig. 1) may contain a solid-state "voice" augmented by graphics for future generations to behold. By extension, a family *astorium* may not only immortalize its builders, but be fashioned to deliver vital information to aid the restoration of civilization in case of a global cataclysm.

Mayan pyramids, for example, mysteriously patterned after Egyptian prototypes across the Atlantic Ocean, are believed to be astorium-type capsules designed to withstand floods caused by oceanic asteroid impact. Fig. 2 shows one of these stunning edifices. It seems that a large asteroid was observed near Earth by the Mayans' excellent astronomers, who feared repeats of legendary collisions in prehistoric times. That an actual asteroid impact transpired some 65 million years ago is evidenced by the presence of a worldwide layer rich in iridium — an element rare in the Earth's crust, but abundant in meteorites. As discovered by planetary scientists Alan R. Hildebrand and William V. Boynton (University of Arizona, Tuscon), an old crater site lies buried under sediment more than a mile deep in the Colombian Basin of the Caribbean Sea. Measuring more than 180 miles in diameter, this feature is twice the size of any impact crater on dry land.

Unfortunately, no conventional time capsule remains extant to explain to posterity such and other concerns, including the rather sudden disap-

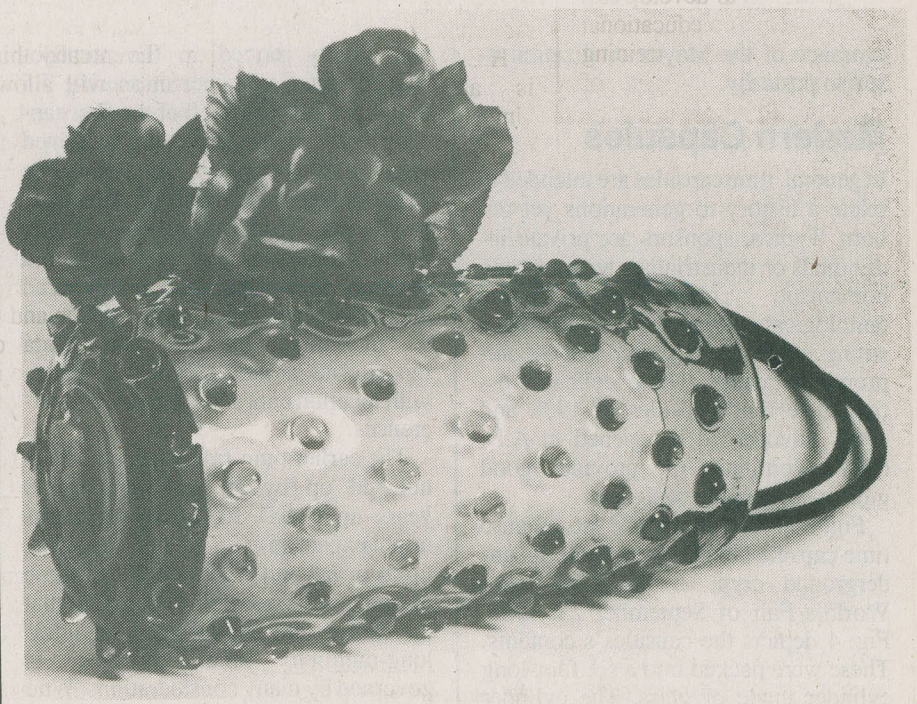

Fig. 1. Electronic time capsule with protective shell and cap removed. Internal ROM voice and paper cache.

Fig. 2. Mayan pyramid structure reflects spirit and scope of astorium. See Text.

pearance of the Mayan civilization itself to posterity.

Modern Capsules

In general, time capsules are intended to relate a history to generations yet unborn. Typical sponsors are private individuals or industrialists with a strong humanistic orientation. While tautological approaches are tolerated, a strong emphasis is placed on uncompromised quality. The excellent Westinghouse time capsules of 1938 and 1965, intended to be opened in A.D. 6939, continue to provide good guidance for many designers.

Fig. 3 shows the first Westinghouse time capsule being lowered into its underground crypt at the New York World's Fair of September 23, 1938. Fig. 4 depicts the capsules's contents. These were packed into a six-foot-long cylinder made of glass. The cylinder was then evacuated, filled with nitrogen for preservation of the contents, sealed, and finally placed in the torpedo-shaped metal container measuring 7.5 feet in length. The shell of the first capsule was comprised of a hardened allow, mainly copper. The shell of the 1965 capsule was made of corrosion-proof steel. Depth of burial was 50 feet below ground. A *Book of Record* told the story. Three thousand, six hundred and forty-nine copies were distributed to museums, libraries and other repositories around the world, replete with location data and astronomical references.

The earlier time-frame has now been notched up by an additional 3,000 years, up to A.D. 10,000. Some clients might expect an even greater extension, up to or beyond A.D. 50,000. In these instances, it is only fair to point out that the design and emplacement of ultra-long-duration time capsules is governed by many considerations. Who or *what*, for example, will read or decipher a given capsule's contents? Will it be a human being or a biological computer? Or will it be an untutored survivor of a global cataclysm? Conversely, a galactic Princess Royal may stand at the other end of time, trying to apply her diagnostic acumen to a broken container marked simply "John Doe/A.D. 1991." Who was this John Doe, she wonders? What did this John Doe do?

Of course, we do not wish to pain this divine child. The key to good capsule management resides in *redundancy*, which calls for capsule duplicates and uniform markers.

Good markers are memorable works of art. If, for example, the universal quadratic form shown in Fig. 5 is chosen, this particular design and style, reduced to manageable dimensions, must be maintained throughout the design and emplacement phases. This may be augmented by an engraved likeness of the capsule's burial container. Damaging electrolysis is suppressed by fabricating all capsule parts of non-magnetic stainless steel type 304.

A strong, reinforced steel shell prevents breakage of the internal glass liner. An excellent glass with a proven service record is Corning's code 7740 borosilicate material. It is true PYREX glass that resists attack by all acids, except *hot* phosphoric and hydrofluoric. Because of 7740's boron content, it is a good neutron absorber. Design stress is up to 1,000 psi and the glass may be tempered to withstand stress of up to 3,000 psi in tension. Note that once tempered, this glass cannot be altered or refabricated. Pyrex has a life expectancy of about one million years. With rare exceptions, most clients do not wish capsules to survive into a presumably new geological age. For special liners and shapes, contact Corning, Inc., Industrial Supplies, MP 21-1-4, Corning, NY 14831.

Other special considerations apply to site surveys. A typical survey begins with an examination of sites deemed secure for capsule emplacement, soil tests for corrosive minerals, and use of a theodolite (fig. 6) for measuring vertical and horizontal angles.

Employ a "station" marking system of good quality. If absolute secrecy is desired, the unsurpassed accuracy of narrow-field magnetic marking suggests itself. A 1.25 inch nail, a ferromagnetic object, makes an excellent

station marker. Even when covered up with up to 8 inches of asphalt, it can easily be located with a Schonstedt GA-52B locator, which saw its baptism as a reliable space-borne magnetometer. Address: Schonstedt Instrument Co., 1175 Wiehle Ave., Reston, VA 22090.

The importance of establishing precise geodetic coordinates cannot be overstressed. Aside from the occasional needs for site inspection, the coordinates will direct future generations to the capsule and ensure that its individuality and uniqueness be recognized. Many aids are available. If you are a bit uncertain in the area of land surveys, study texts offering *practical* advice and expert guidance on evaluating land survey plots, legal descriptions, and how to conduct basic surveying procedures. In the United States, the book, *Understanding Land Surveys*, written by surveyor Steve Estopinal, is one of the best. Contact: Processional Education Systems, Inc., Box 1208, Eau Claire, WI 54702.

In this connection, you may also wish to consider geographic software. IBM has an excellent software program that allows you to create, maintain, and access geographic information across a multitude of data bases. The *Geo-Manager*, as the program is called, works with a graphics-capable IBM 3270-compatible terminal. The purchase price is high, but monthly license charges are available. Contact: Jim Keller, IBM, U.S. Marketing Services, 1133 Westchester Ave., White Plains, NY 10604.

Capsule Instrumentation

Early on, a decision must be made regarding the capsule's electronic inventory and the survivability of internal support equipment through the millennia yet to come. Direct your client(s) accordingly.

Using staggered ROM (read only) speech memory chips, for example, a time capsule can be encoded by conventional means to *speak* to future generations. This capability may be augmented by an acoustically or mechanically engraved tinfoil cylinder reminiscent of Edison's first foil phonograph. Arrange this "voice" in a protective, padded shell (Fig. 7). The foil cylinders may be slipped over the ROMs which have their own electrical connector for encoding and testing. The use of internal, battery-type power supplies is not recommended due to the danger of corrosion. Enclose concise instructions before sealing the liner and applying an inert gas atmosphere (argon or helium) to safeguard against decomposition.

Be aware of space limitations! The inclusion of *books* should be discouraged. We now have new electronic media that permits inclusion of CD-ROM-based encyclopedias within a small volume of space. It is by means of such reference works that a maximum of information can be delegated to posterity. New items include *Compton's MultiMedia Encyclopedia* and *World Book's Information Finder*, among others. Grolier pioneered the CD-ROM encyclopedia with its first edition of the *Electronic Encyclopedia* in 1986. Today's version includes more than 1,500 colour photos that are displayable on computers with VGA monitors. For review and general display, this item requires a 512K RAM, VGA for graphics, CD-ROM drive with Microsoft CD-ROM Extensions, Version 2.1; DOS 3.0 or later. Source: Grolier Electronic Publishing, Sherman Turnpike, Danbury, CT 06816.

However, be aware that *magnetic*-type storage media tend to weaken over a period of time. Package these materials in a mu-metal containment shell for long-term preservation. A laser-inscribed glass disc offers certain advantages here, as does archival paper inscribed with acid-free ink.

Technical developments notwithstanding, *handwritten* paper documents still have the best chance of sur-

Fig. 3. First Westinghouse time capsule of 1938. See text for description. Left, holding capsule: A.W. Robertson, Chairman of the Board, Westinghouse Corporation. Right: Grover A. Whalen, President of New York World's Fair, 1938.

Fig. 4. Mr. Whalen, seated, signs manifest of 1938 time capsule's contents. Films, microfiche with viewer, household, sports, and scientific items conprised a well-rounded profile of contemporary civilization.

viving the ravages of time. A few words about paper:

A good time-capsule paper is of the neutral pH (NpH) type devoid of acids. On the acid-alkalinity scale from 0 to 14, its pH must be 7.0 or neutral. Use the *alpha cellulose* type. It is a museum-quality, archival paper devoid of ferric oxide, copper sulphate compounds, and without optical brighteners, bleaching residues or other fading elements.

Ask museums for recommended sources of paper. We have a Catch-22 here in that only a very few paper mills around the world have access to a pH-neutral (pH 7.0) water supply. Investigate if the mill is located near a lake or river. Chemical purification will remove a large amount of minerals and impurities from the water, but often not enough for an excellent archival rating. Watch out for the phenomenon of "foxing" — the reddish-brown spots on old paper. This is caused when the mill's water contains trace elements of iron and copper in various degrees of chemical combinations.

The acidity problem precludes the use of newspaper clippings in time capsules. If you or your clients insist on this type of historical presentation, it is best to have the information etched into thin steel foil. The same applies to photographs, which must be "screened" (broken up into fine dots or pixels) for the engraving process. Special masks, metal patterns and precision artwork are provided by various companies. including Applied Image, Inc., 1653 E. Main St., Rochester, NY 14609. This particular firm also does electro-forming and chemical milling on glass.

Repositories

It is often necessary that a completed and fully encoded time capsule be withheld from ground emplacement for a variety of reasons, including corrosion tests in ambient air. Long-duration skin tests can be conducted in secure storage rooms or, of so elected, in crypt structures such as shown in Fig. 8. Theft is safeguarded against by furnishing the capsule with a temporary ferromagnetic iron bar, which is placed against the granite or concrete closure plate from within. Using a simple instrument such as a metal detector (also known as a "treasure finder"), the capsule's presence can then be verified at frequent intervals by simply sweeping the detector across the iron bar's known position. Vandalism is avoided by *not* including noble metals (gold, silver, etc.) in the capsule's contents.

Another type of repository deals with emplacement data of the geographic type. Only if the capsule itself is immortalized and internationally recorded in the ancient traditions can the project be called complete.

Time has taught that the best of data repositories are monasteries. They are self-sufficient and usually immune to political upheavals. Be guided by a monastery's history and art. A timeless, intensely cosmic outlook is important. A perusal of the following book is highly recommended:

Sitwell, S.: *Monks, Nuns and Monasteries*,
Holt, Rinehart and Winston, NY., 1965.

(For more condensed information, see the *Academic American Encyclopedia*, Grolier, Danbury, CT 1987, pp. 517-521.)

It is expected that a new, highly secure site for actual time-capsule emplacement will become available at the Mount Rushmore National Monument in South Dakota. Featuring the well-known heads of fours U.S. presidents, the monument has been targeted for a four-year, $60 million restoration, which includes mapping and repair of cracks (Fig. 9). The project includes enlargement of the presently small visitors' facilities, improvement of security operations, and completion of the *Hall of Records*, a 68-foot-long tunnel near the top of the granite mountain. The tunnel's structural stability will be determined shortly.

Summary

Temporal and funeralistic connotations notwithstanding, time capsules deal with *life*. Thus, when entering into this fascinating field, it is prudent to consider the status of a possibly supremely advanced, now-immortal civilization residing on Earth some 7,000 or more years hence. The galaxy has been explored; there are no economic or political problems as we understand them; the planet's population is small and has assumed a pastoral life-style. An occasional starship brings mail or relatives from distant worlds, and com-

munication is of a galaxy-wide configuration. Yet it is likely that this culture continues to place a premium on education and has as intense an interest in its ancient forefathers as we have today.

Thus, then, a time capsule's contents can be tailored in that direction. It will demonstrate that we, too, had a sense of historical responsibility that reached far beyond private self-interests. After all — *OMNE VIVUM EX VIVO*, life comes from life. ❐

Fig. 5. A capsule marker sample, quadratic type. See text.

Fig. 6. Field survey operations in progress. Concise geodetic data are imperative to time capsule enplacement and recovery. See text for suggested data base.

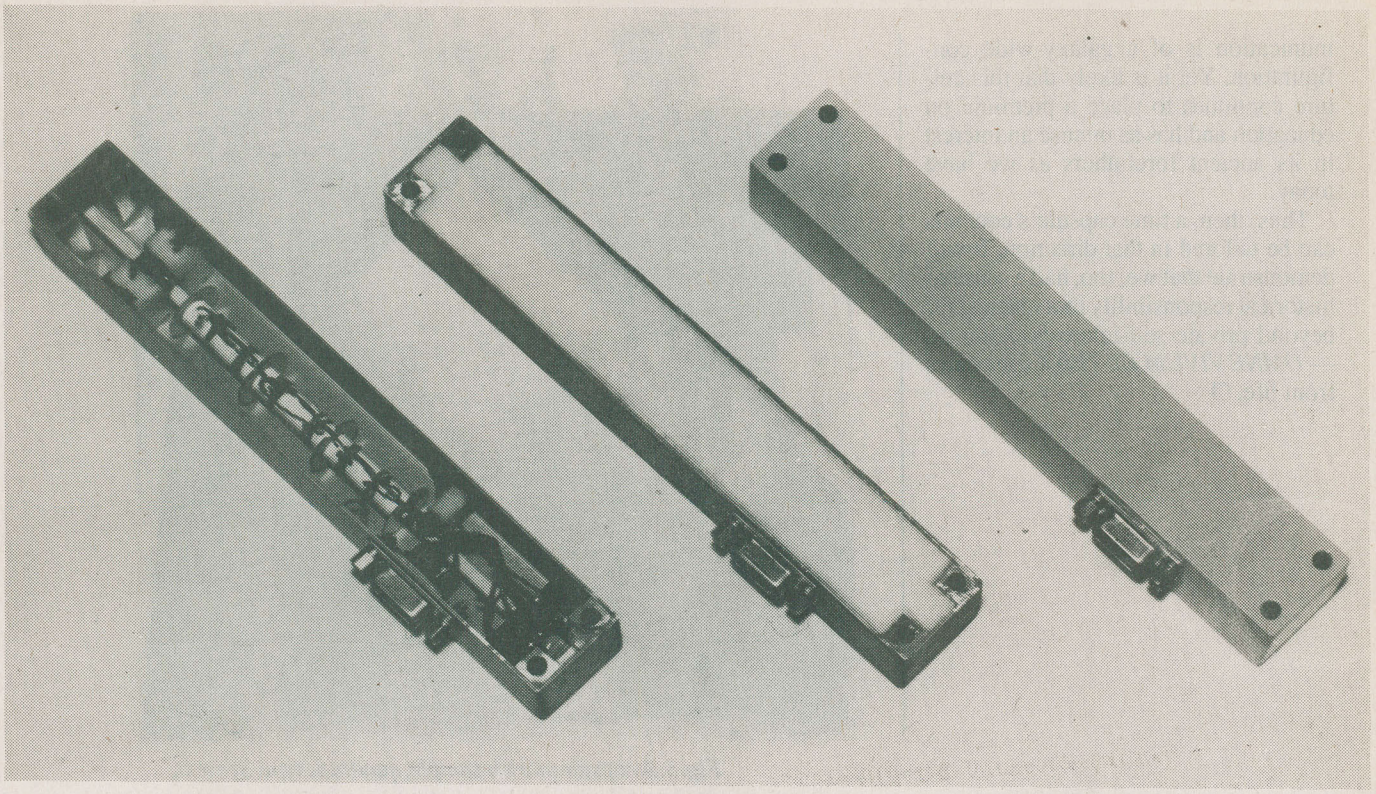

Fig. 7. Protective shell with electronics. No internal batteries are used to prevent corrosion damage. See text.

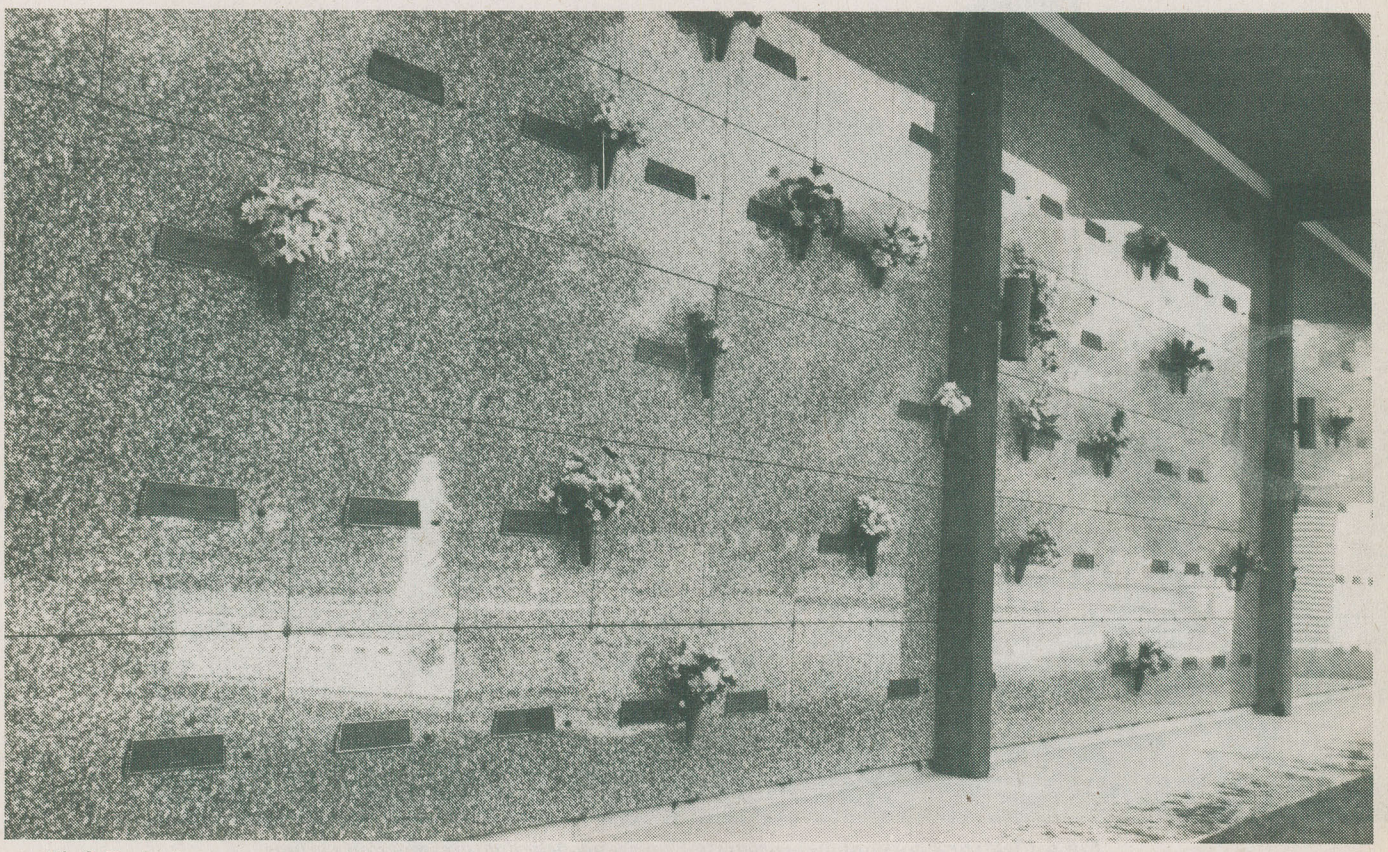

Fig 8. Typical crypt structure with granite closure plates is shown — a temporary time capsule repository. Presence of capsule can be confirmed periodically with beat-frequency metal detector. See text.

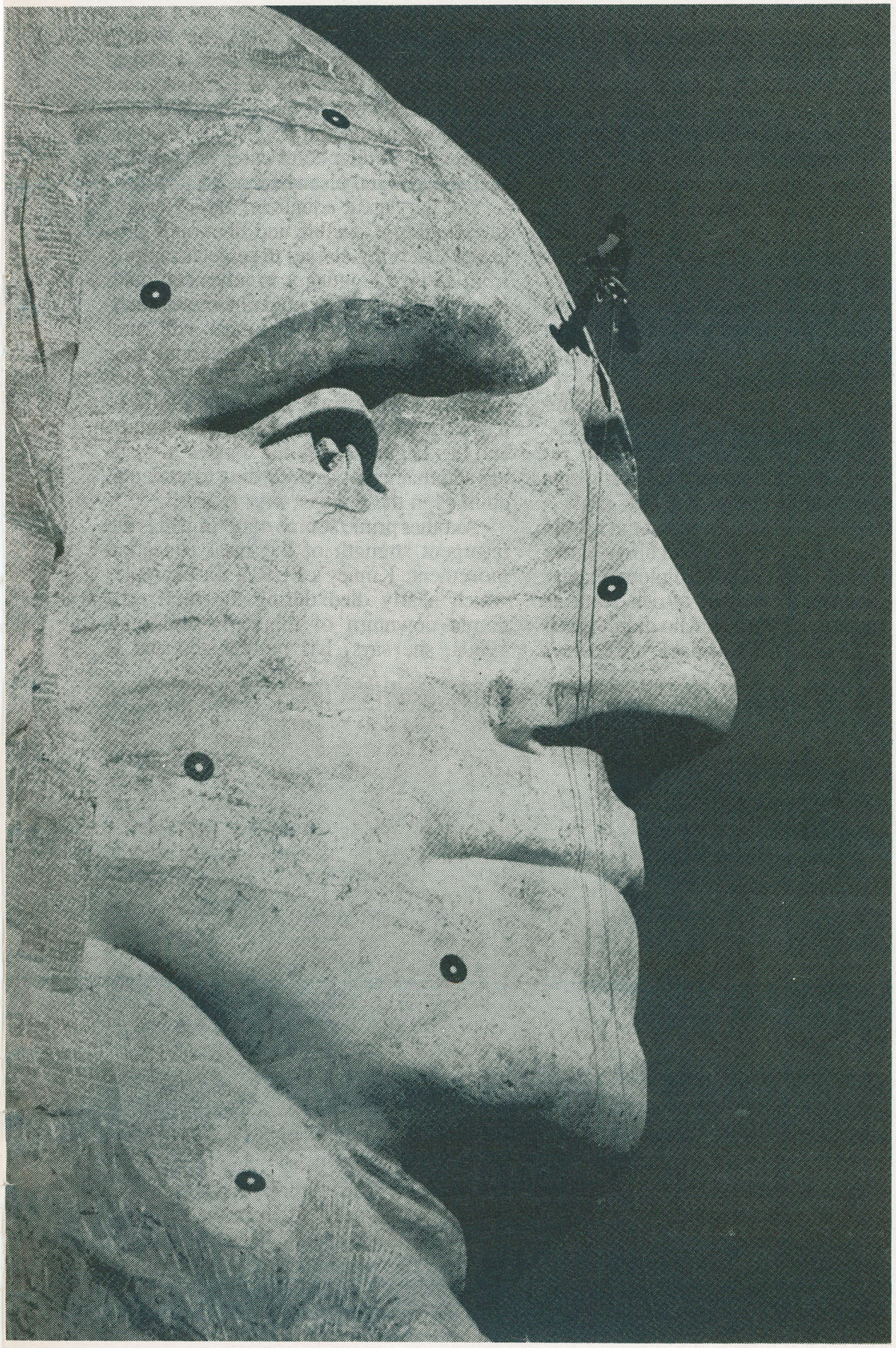

Fig. 9. Washington's face at Mount Rushmore National Monument being tested for cracks in granite. See text.

Aerial photo courtesy U.S. National Park Service.

Industry News

Cont'd. from page 30

time (which was 31 degrees Fahrenheit) implied a 15 percent chance of failure; if the launch had been delayed until the temperature reached 60 degrees Fahrenheit, the probability of failure would have been reduced to only two percent.

The award recipients are Dr. Siddhartha R. Dalal, district manager, statistics and econometrics research group; Dr. Bruce Hoadley, division manager, analytical methods and software division; and the late Edward B. Fowlkes, distinguished member of technical staff, statistics research division.

The awards, given at the 150th Annual Meeting of the ASA in Anaheim, California, recognize outstanding applications of statistics in the physical, biological or medical sciences. The paper is titled "Risk Analysis of the Space Shuttle: Pre-Challenger Prediction of Failure."

The risk analysis work was triggered by the appointment of Dr. Hoadley to serve on an 11-member advisory committee to the government's space program. The advisory panel, operating under the auspices of the National Research Council (NRC), was formed at the request of the Presidential Commission on the Space Shuttle Challenger Accident.

"One of the major issues the NRC wanted to look at was the value of quantifying the probability of equipment failure, something NASA had rarely done before," Hoadley said. "Because NASA engineers hadn't calculated the exact risk of a particular component failing, NASA wanted the NRC to review and suggest mathematical models that could determine probability of failure," he added.

"The techniques developed for analyzing the Challenger disaster can also be used to study the survivability of telephone networks, as in assessing potential risks of fire," said Dalal. When high risks are indicated by using this risk analysis method — whether for spacecraft, telephone networks or any large complex systems — engineering design changes can be made.

Results of this research have already influenced NASA, which is in the process of creating a statistical sciences research group. ❐

Tube Sound

Cont'd. from page 20

proponents of tube sound laud as the virtues of vacuum tubes are really bugs which tube amplifiers never really managed to solve.

Tubes, for example, are said to have better bass. This is largely because they have sort of awful high ends... the impedance of the output transformer's primary goes up as the frequency passing through it does, and the efficiency of the output tubes starts to fall off in the treble as well.

The warmer, richer sound of tube amplifiers is largely distortion... you can get a similar sort of warm, rich sound by getting a really cheap stereo from Sears.

Oddly, the one thing that tubes do well, handling lots of power, isn't what the current generation of hybrid tube amplifiers seems to use them for. An amplifier with low noise, low distortion transistors in its small signal sections and a couple of power pentodes to drive the speakers would arguably combine the best features of the two technologies. However, perhaps because output tubes and transformers are too big and too expensive to fit into the confines of contemporary stereo equipment, most amplifiers with "tube sound" arrive at it by including a couple of tubes as preamps.

You can arrive at much the same power handling characteristics of tubes... at least for audio applications... by simply using a large enough solid state amp to handle any peaks and transients you're likely to encounter. Unless you specifically like the distortion, noise, hum, intermodulation, crosstalk, harmonics, microphonics, heat, short life span, power consumption, size, weight and expense of tubes, tube sound will probably be little more than a manufacturer's ploy to sell trendy stereo hardware.

The tube sound's already in rock 'n roll. It probably doesn't belong in most other sorts of music.

While tubes do have their places, even today, high fidelity sound probably isn't one of them. Manufacturers who tell you that nothing quite sounds like a tube probably hire the same advertising agencies who will tell you that nothing quite accelerates like a Honda Civic, tastes like Kraft cheese, makes friends like a pit bull or lies like Michael Wilson. All of these things may well be true, but they're hardly features.

The last time I went to retube my guitar amp, output tubes cost seventy-five dollars a pair... this was about five years ago. You might want to consider this, too, as another of the unspoken features of tube sound. ❐

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